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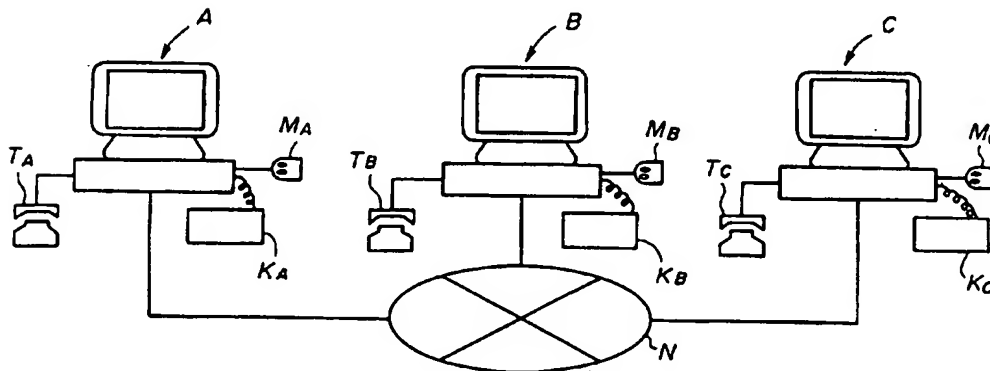
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## (54) Conferencing system

(57) An application sharing system has computer terminals which are connected to a network, a shared application which is commercially available being installed in the plurality of computer terminals. When an event is input to a computer terminal, a process corresponding to the event is performed in accordance with the shared application in the computer terminal and in other computer terminals. Each of the plurality of computer terminal includes an event determination unit for determining what an input event is, a file transmission unit, when the event determination unit determines that the input event is an open command for a file, for transmitting the file to another computer terminal, a received file managing unit for receiving and managing the file which is transmitted based on an open command in another computer terminal, and an event simulating unit, when the file is transmitted based on an open command in another computer terminal, for simulating an event corresponding to an open command for opening the file which is managed by the received file managing unit in the shared application.

FIG. 1



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1                   "APPLICATION SHARING SYSTEM"

          The present invention generally relates to  
          an application sharing system, and more particularly  
5       to an application sharing system in which application  
          software, such as text editors, spread sheets and  
          white boards, is shared by a plurality of computers  
          which are located at different sites and connected to  
          each other via a limited band width communication  
10       channel.

          Many computer mediated conference system  
          have been developed recently (Japanese Laid Open  
          Patent Application No.62-53084, No.63-1139, No.2-96263  
          and No.3-119476 and "MULTIMEDIA REPLICATED APPROACH  
15       CONFERENCE SYSTEM: MERMAID - APPLICATION SHARING BY  
          REPLICATED APPROACH CONTROL, NEC Co. Ltd, OS91-12 17p-  
          24p"). In these system, the same information  
          generated in accordance with a shared application is  
          displayed, in realtime, on screens of computers  
20       connected to each other by a communication network  
          such as an ISDN or a LAN. In this state, while  
          pointing positions on the screens of the respective  
          computers, a conference is executed by use of an audio  
          channel among users of the computers. In addition,  
25       pictures drawn by drawing operations of users in the  
          respective computers are superposed on images  
          displayed on the screen of the respective computers.

          There are two method of realizing the  
          application sharing. In the first method, an  
30       application program for the application sharing is  
          originally developed. In the second method,  
          application software which is commercially available  
          is used. The first method has an advantage in that  
          new functions suitable for the application sharing can  
35       be originally added to the application program. The  
          second method has an advantage in that an application,  
          such as a word processor, a spread sheet or the like,

1     which is commercially available user can be used  
without changing it.

       In addition, there are two types of  
application sharing systems. The first type is  
5     referred to as a centralized approach application  
sharing system. In the centralized approach  
application system, a single computer is provided with  
an application, and processing results in the  
application are transmitted to other computers via the  
10    communication network. Thus, a large amount of data  
must be transmitted using the network. As a result, a  
high-speed communication circuit is required for the  
centralized approach application sharing system.

       The second type is referred to as a  
15    replicated approach application sharing system. In  
the replicated approach application sharing system,  
the respective computers are provided with the same  
applications and events input to a computer are  
transmitted to other computers via the communication  
20    network. As a result, processes in accordance with  
the events in the application are executed in the  
respective computers. The replicated approach  
application sharing system is disclosed, for example,  
in Japanese Patent Laid Open Application No.3-17763  
25    (CONVERSATION BACK-UP DEVICE), No.4-186456 (COMMON  
INFORMATION PROCESSING SYSTEM AND WORK STATION), No.4-  
307648 (GROUP COOPERATIVE JOB DEVICE) and No.5-233507  
(MESSAGE COMMUNICATION SYSTEM FOR GROUP COOPERATIVE  
WORK).

30       Although the high-speed communication  
circuit is not required for the replicated approach  
application sharing system, the conventional  
replicated approach application sharing system has the  
following disadvantages.

35       Structures of directories formed in the  
respective computers differ from each other. Thus,  
when an "open file" command is requested with a path

1     name of a file as a parameter by a user of a computer,  
other computer cannot identify the same file using the  
same path name of the file.

5     Therefore, the computers in the conventional  
replicated approach application sharing system must  
have the same files and the same directory structures.  
However, it is very troublesome to prepare the same  
files and the same directory structures beforehand in  
the respective computers.

10     In addition, in the conventional replicated  
approach application sharing system, an event input to  
a computer is supplied to all other computers and a  
corresponding process is performed in each of the  
computers. Thus, when a command such as a "save  
15    command" or a "print command" is requested at a  
computer, the "same command" or the "print command" is  
executed in all the other computers. In this case,  
the flowing problems occurs.

20     A file may be saved and/or printed in a  
computer against user's wishes. That is, the file  
which is not required by the user may be saved or  
printed in a computer.

25     Further, in the conventional replicated  
approach application system, a "floor control" is  
introduced to avoid a race condition of simultaneous  
inputs. That is, only a user who gets the floor can  
input commands to a shared application. However, in a  
case where an application which is commercially  
available is shared, in order to add the floor control  
30    to the system, an original application source codes  
must be modified. Thus, it is required to add the  
floor control to the system without changing original  
application source codes in the application which is  
commercially available.

35     In addition, in the replicated approach  
application sharing system, an event input to a  
computer having the floor is supplied to an

1 application in the computer and is supplied to  
applications in other computers via a network.  
However, there is a case where operating environments  
(e.g., window sizes in an initial state, font sizes  
5 used in applications and operating conditions for user  
customizing) in each of the other computers differ  
from those in the computer having the floor. In this  
case, even if the same event is supplied to all the  
computers, the same operation is not performed in the  
10 computers.

Furthermore, in cases where hand written  
comments are drawn on a screen of a computer based on  
an application which is commercially available and a  
pointer is superposed on an image displayed on the  
15 screen based on an application which is commercially  
available, a copy of the screen made by the  
application which is commercially available is formed  
on a common screen made by a dedicated application for  
an electronic blackboard and the drawing is then  
20 performed on the common screen. However, complex  
operations (including a copy operation) are required.

Accordingly, a general object of the present  
invention is to provide a novel and useful application  
sharing system in which the disadvantages of the  
25 aforementioned prior art are eliminated.

A specific object of the present invention  
is to provide an application sharing system in which a  
common file is not needed to be previously prepared in  
computer terminals other than a computer terminal to  
30 which an event has been input.

Another object of the preset invention is to  
provide an application sharing system in which the  
structure of the directory in each computer terminal  
is not needed to be the same as that of the directory  
35 in a terminal to which an open command (an event) has  
been input.

The above objects of the present invention

1 are achieved by an application sharing system in which  
a plurality of computer terminals are connected to a  
network, a shared application which is commercially  
available being installed in the plurality of computer  
5 terminals, when an event is input to a computer  
terminal, a process corresponding to the event being  
performed in accordance with the shared application in  
the computer terminal and in other computer terminals,  
each of the plurality of computer terminal comprising:  
10 event determination means for determining what an  
input event is; file transmission means, when the  
event determination means determines that the input  
event is an open command for a file, for transmitting  
the file to another computer terminal; received file  
15 managing means for receiving and managing the file  
which is transmitted based on an open command in  
another computer terminal; and event simulating means,  
when the file is transmitted based on an open command  
in another computer terminal, for simulating an event  
20 corresponding to an open command for opening the file  
which is managed by the received file managing means  
in the shared application.

According to the present invention, since a  
file is transmitted to the other computer terminal,  
25 the common file is not needed to be previously  
prepared in computer terminals other than a computer  
terminal to which an event has been input.

In addition, in a case where the received  
file managing means has file storage means for storing  
30 the received file in a directory set by a user, the  
structure of the directory in each computer terminal  
is not needed to be the same as that of the directory  
in a terminal to which an open command (an event) has  
been input.

35 A still another object of the present  
invention is provide an application sharing system in  
which a process to be carried out when an event is

1     input to a computer terminal having no floor is  
established.

          This object of the present invention is  
achieved by an application sharing system in which a  
5     shared application is executed in a plurality of  
computer terminals which are connected to a network,  
the shared application being commercially available,  
each of said plurality of computer terminals  
comprising: input hook means for copy an input event  
10    and for inhibiting the input event from being supplied  
to the shared application; input event simulating  
means for simulating an input event to be supplied to  
the shared application; floor control means for  
controlling presence and absence of a floor based on  
15    which an event is accepted; and communication control  
means for transmitting information to other computer  
terminal via the network, wherein an event input to a  
first computer terminal which is set in a state of the  
presence of the floor by the floor control means is  
20    supplied to the shared application and copied by the  
input hook means, the communication control means  
transmitting the copied event to a second computer  
terminal which is set in a state of the absence of the  
floor by the floor control means, and wherein when the  
25    event from the first computer terminal is received by  
the second computer terminal, the input event  
simulating means simulates the received event so that  
the shared application is executed based on the  
simulated event in the same manner as in the first  
30    computer terminal, an event input to the second  
computer terminal being inhibited from being supplied  
to the shared application by the input hook means.

          According to the present invention, the  
event input to the second computer terminal having no  
35    floor is inhibited from being supplied to the  
application. Thus, even if an event is input to the  
second computer terminal having no floor, the

1 application is not executed based on the event in the  
second computer terminal.

Another object of the present invention is  
to provide an application sharing system ensuring that  
5 an application which is commercially available will be  
executed under the same operating environments in the  
respective computer terminals.

This object of the present invention is  
achieved by the application sharing system described  
10 above in which an operating environment file defining  
operating environments for the shared application is  
transmitted from the first computer terminal which is  
set in a state of the presence of the floor to the  
second computer terminal which is set in a state of  
15 the presence of the floor, and wherein the second  
computer terminal which receives the operating  
environment file substitutes the received operating  
environment file for an original operating environment  
file.

20 According to the present invention, an  
application which is commercially available can be  
executed under the same operating environments in the  
respective computer terminals

Another object of the present invention is  
25 to provide an application sharing system in which hand  
written comments can be easily drawn and/or a pointer  
can be easily superposed on a screen made by an  
application which is commercially available.

This object of the present invention is  
30 achieved by an application sharing system in which a  
shared application is executed in a plurality of  
computer terminals which are connected to a network,  
the shared application being commercially available,  
each of said plurality of computer terminals  
35 comprising: pointing means, independent of the shared  
application, for pointing a position on a screen of a  
display device; input hook means for copying an event



1     occurring when a position on the screen is pointed by  
the pointing means and inhibiting pointed position  
information from the pointing means from being  
supplied to the shared application; mode setting means  
5     for setting an operating mode in a drawing mode or a  
normal mode; drawing means for drawing images on the  
screen based on the pointed position information from  
the pointing means; input simulating means for  
simulating events to be supplied to the shared  
10    application; and communication control means for  
transmitting information to other computer terminal  
via the network, wherein when a first computer  
terminal is set in the normal mode by the mode setting  
means, an event occurring based on a position which is  
15    pointed on the screen by the pointing means is  
supplied to the shared application and is copied by  
the input hook means, the event copied by the input  
hook means being transmitted to a second computer  
terminal by the communication control means, the input  
20    simulating means of the second computer terminal  
simulating the event from the first computer terminal  
so that the share application is executed in the  
second computer terminal in the same manner as in the  
first computer terminal, and wherein when the first  
25    computer terminal is set in the drawing mode by the  
mode setting means, pointed position information from  
the pointing means is inhibited from being supplied to  
the shared application and the drawing means draws  
images on the screen based on the pointed position  
30    information, the pointed position information being  
transmitted to the second computer terminal by the  
communication control means, the drawing means of the  
second computer terminal which receives the pointed  
position information draws images based on the screen  
35    based on the pointed position information.

According to the present invention, since  
each computer terminal has the mode setting means, the

1 input hook means and the drawing means, hand written  
comments can be easily drawn and/or a pointer can be  
easily superposed on a screen made by an application  
which is commercially available.

5 Other objects, features and advantages of  
the present invention will become apparent from the  
following detailed description when read in  
conjunction with the accompanying of drawings, in  
which:

10 Fig. 1 is a diagram illustrating a system  
according to an embodiment of the present invention;

Fig. 2 is a block diagram illustrating a  
structure of each computer terminal provided in the  
system according to the embodiment of the present  
15 invention;

Fig. 3 is a table illustrating a  
relationship between analysis results obtained by an  
input event analyzing unit and processes;

20 Fig. 4 is a block diagram illustrating a  
structure of hardware of each computer terminal  
provided in the system according to the embodiment of  
the present invention;

Fig. 5 is a diagram illustrating an example  
of a screen on a display unit;

25 Fig. 6 is a diagram illustrating an example  
of the screen on the display unit;

Fig. 7 is a flow chart illustrating a  
process in a case where an open command is input to a  
computer terminal;

30 Fig. 8 is a flow chart illustrating a  
process in a case where a general command is input to  
a computer terminal;

Fig. 9 is a flow chart illustrating a  
process in a case where a file save command or a print  
35 command is input to a computer terminal;

Fig. 10 is a block diagram illustrating an  
example of a functional structure of each user

1 computer terminal in an application sharing system;

Fig. 11 is a block diagram illustrating  
another example of a functional structure of each user  
computer terminal an application sharing system;

5

Fig. 12 is a diagram illustrating an  
application sharing system according to an embodiment  
of the present invention;

Fig. 13 is a block diagram illustrating an  
10 example of a structure of each user computer terminal  
shown in Fig. 10;

Fig. 12 is a flow chart illustrating a  
procedure in a case of start-up of the application  
15 sharing system;

Fig. 13 is a state transition diagram  
illustrating states of a sharing agent in a primary  
terminal in the application sharing system;

Fig. 14 is a state transition diagram  
20 illustrating states of a secondary terminal in the  
application sharing system;

Fig. 15 is a diagram illustrating an example  
of a displayed screen, of a user computer terminal, on  
which a control button of a suspension/resumption  
25 function is provided;

Fig. 16 is a state transition diagram  
illustrating states of a primary computer terminal in  
a suspension/resumption process;

Fig. 17 is a state transition diagram  
30 illustrating states of a secondary computer terminal  
in the suspension/resumption process;

Fig. 18 is a diagram illustrating an initial  
screen in a primary computer terminal in the  
application sharing system;

35 Fig. 19 is a diagram illustrating an initial  
screen in a secondary computer terminal in the  
application sharing system;

1        Fig. 20A is a diagram illustrating a screen  
in a primary computer terminal which is being  
initialized;

5        Fig. 20B is a diagram illustrating a screen  
in a secondary computer terminal which is being  
initialized;

10       Fig. 21A is a diagram illustrating a  
displayed screen in a primary computer terminal in a  
state where the primary computer terminal and a  
secondary computer terminal are linked to each other;

Fig. 21B is a diagram illustrating a  
displayed screen in a secondary computer terminal in a  
state where a primary computer terminal and the  
secondary computer terminal are linked to each other;

15       Fig. 22A is a diagram illustrating a  
displayed screen in a primary computer terminal after  
a text made by using of a shared application is  
transmitted from the primary computer terminal to a  
secondary computer terminal;

20       Fig. 22B is a diagram illustrating a  
displayed screen in a secondary computer terminal  
after a text made by using of a shared application is  
transmitted from the primary computer terminal to the  
secondary computer terminal;

25       Fig. 23A is a diagram illustrating a  
displayed screen in a primary computer terminal in a  
drawing process mode;

30       Fig. 23B is a diagram illustrating a  
displayed screen in a secondary computer terminal in  
the drawing process mode;

Figs. 24A and 24B are diagrams illustrating  
a control panel and movement of a window for an  
application;

35       Figs. 25A and 25B are diagrams illustrating  
a size changing bar and movement of a window of an  
application;

Figs. 26A and 26B are diagram illustrating

1 movement of a window for an application and control  
windows;

Fig. 27 is a diagram illustrating a state of  
a control window in a case where a window for an  
5 application is maximized; and

Fig. 28 is a diagram illustrating a state of  
a control window in a case where a window for an  
application is changed to an icon.

A description will be given of embodiments  
10 of the present invention.

A file sharing system according to an  
embodiment of the present invention is formed, for  
example, as shown in Fig. 1. Referring to Fig. 1, a  
plurality of computer terminals A, B and C are coupled  
15 to each other by a communication network N. The  
respective computer terminals A, B and C have input  
units  $I_A$ ,  $I_B$  and  $I_C$  and telephone sets  $T_A$ ,  $T_B$  and  $T_C$ .  
The respective input units  $I_A$ ,  $I_B$  and  $I_C$  are formed of  
keyboards  $K_A$ ,  $K_B$  and  $K_C$  and mice  $M_A$ ,  $M_B$  and  $M_C$ . A  
20 common application is installed in the respective  
computer terminals A, B and C. In this system, while  
users are speaking to each other on the telephone  
sets, drawing on a common text displayed on each  
display unit can be performed. In addition, a user  
25 can explain something to another user on the telephone  
set while pointing positions on a displayed screen  
using a pointer.

A functional structure of each computer  
terminal is formed, for example, as shown in Fig. 2.

30 Referring to Fig. 2, a computer terminal has  
an input unit 101, a display unit 102, a printer unit  
110, a file storage unit 103, a communication control  
unit 104 and an application executing unit 105. The  
input unit 101 is used to input event information such  
35 as editing commands. A file to be processed (edited)  
is displayed in a predetermined window on the display  
unit 102. The printer unit 110 prints a file. Files

1 are stored in the file storage unit 103. The  
communication control unit 104 communicates with  
another computer terminal via the communication  
network. The application executing unit 105 executes  
5 an application in accordance with the event  
information input by the input unit 101 or supplied  
via the communication network. The computer terminal  
further has a input event copy unit 106, an input  
event analyzing unit 107 and an input event simulating  
10 unit 108. The input event copy unit 106 copies the  
event information supplied from the input unit 101 to  
the application executing unit 105. The input event  
analyzing unit 107 analyzes the input event  
information and determines what the input event  
15 information is. The input event simulating unit 108  
simulates event information supplied to another  
computer terminal and supplies the simulated event  
information to the application executing unit 105.

The input event analyzing unit 107 performs  
20 processes corresponding to analyzed results as shown  
in Fig. 3. That is, when it is determined that event  
information input the input event analyzing unit 107  
is an open command, the input event analyzing unit 107  
supplies to the communication control unit 104 an  
25 instruction to transmit a file. In addition, when it  
is determined that the input event information is a  
print command to print a file or a save command to  
save a file, the input event analyzing unit 107  
terminates a process. The print command or the save  
30 command is not transmitted to another computer  
terminal. Further, it is determined that the input  
event information is another command, the input event  
analyzing unit 107 supplies to the communication  
control unit 104 an instruction to transmit the input  
35 event information to another computer terminal.

The application executing unit 105 in each  
of the computer terminals is provided with a common

1 application.

A hardware structure of the computer terminal having the functional structure described above is formed as shown in Fig. 4.

5 Referring to Fig. 4, the computer terminal has a processor (CPU) 201, a memory 202, an output control unit 203, an image memory 220, a printer 204, a display device 205 (e.g., a CRT display device, a liquid crystal display device, an EL display device or  
10 a plasma display device), a keyboard interface 206, a keyboard 207, a mouse interface 208, a mouse 209, a file interface 210, a filing device 211 (e.g., a hard disk device or a floppy disk device), an ISDN interface 212, a dialing key set 213, a hand set 214  
15 and a hook switch 215. The processor (CPU) 201, the output control unit 203, the keyboard interface 206, the mouse interface 208, the file interface 210 and the ISDN interface 212 are connected to each other via a system bus, so that the output control unit 203 and  
20 the devices connected to the respective interfaces 206, 208, 210 and 212 are controlled based on instructions from the processor (CPU) 201. The memory 202 is also connected to the processor (CPU) 201 via the system bus, and the processor (CPU) 201 performs  
25 processes in accordance with programs, such as application programs, stored in the memory 202. The display device 205 and the printer 204 are controlled by the output control unit 203 so that image information (contents of a file) stored in the image  
30 memory 220 is displayed on the display device 205 and is printed out by the printer 204. The ISDN interface 212 is connected to the ISDN (the communication network). Information (including event information, file information and conversation information) is  
35 transmitted from the ISDN interface 212 to an ISDN interface of another computer terminal via the ISDN.

A function of the input unit 101 shown in

1 Fig. 2 is realized by the keyboard interface 206, the  
keyboard 207, the mouse interface 208 and the mouse  
209 shown in Fig. 4. Functions of the display unit  
102 and the printer unit 110 shown in Fig. 2 are  
5 realized by the output control unit 203, the printer  
204, the display device 205 and the image memory 220.  
A function of the file storage unit 103 shown in Fig.  
2 is realized by the file interface 210 and the filing  
device 211 shown in Fig. 4. A function of the  
10 communication control unit 104 shown in Fig. 2 is  
realized by the ISDN interface 212, communication  
software stored in the memory 202 and the processor  
(CPU) 201 shown in Fig. 4. A function of the  
application executing unit 105 shown in Fig. 2 is  
15 realized by the application software stored in the  
memory 202 and the processor (CPU) 201 shown in Fig.  
4. Functions of the input event copy unit 106, the  
input event analyzing unit 107 and the input event  
simulating unit 108 shown in Fig. 2 are realized by  
20 the software stored in the memory 202 and the  
processor (CPU) 201 shown in Fig. 4.

A description will now be given of  
operations in a case where an application of a word  
processor is shared by the computer terminals A and B  
25 shown in Fig. 1.

An initial screen in a word processor is  
displayed on the displayed device 205 of the computer  
terminal A, for example, as shown in Fig. 5. In this  
initial screen, icons corresponding to events "OPEN  
30 FILE", "SAVE", "PRINT", "INSERT" and "DELETE" are  
formed in a menu bar. In this state, when a user  
clicks the mouse 209 to select an icon of "OPEN FILE",  
the initial screen on the display unit 205 is changed  
to a screen showing a list of files stored in the  
35 filing device 211, as shown in Fig. 6. When the user  
clicks the mouse 209 to select a title of a desired  
file, the selected file is opened in the word



1 processor (the application) and contents of the  
selected file is displayed on the display device 205.

When a "OPEN FILE" command for reading a  
file (an open command) is input to the computer  
5 terminal A as has been described above, the selected  
file is opened in the computer terminal A and a  
process is executed in accordance with a procedure  
shown in Fig. 7.

Referring to Fig. 7, when the user inputs a  
10 "OPEN FILE" command (the open command for a file) to  
the computer terminal A, the input event copy unit 106  
copies the "OPEN FILE" command, a pass name  
identifying a position in a directory at which a file  
identified by the "OPEN FILE" command is stored is  
15 supplied to the input event analyzing unit 107. When  
the input event analyzing unit 107 determines that  
event information supplied thereto is the "OPEN FILE"  
command, the input event analyzing unit 107 supplies  
to the communication control unit 104 a file  
20 transmission request having the pass name and the size  
of the file as parameters in accordance with the  
relationship shown in Fig. 3. The communication  
control unit 104 transmits the file transmission  
request having the size of the file as a parameter to  
25 the communication control unit 104 of the computer  
terminal B via the ISDN.

In the computer terminal B, when the  
communication control unit 104 receives the file  
transmission request, the communication control unit  
30 104 requests of the file storage unit 103 to check  
whether the file having the size indicated as the  
parameter can be stored in the file storage unit 103.  
If the storage unit 103 informs the communication  
control unit 104 that the file can be stored therein,  
35 the communication control unit 104 of the computer  
terminal B transmits to the communication control unit  
104 of the computer terminal A, via the ISDN,

1 information indicating that the transmission request  
has been received by the computer terminal B. When  
the communication control unit 104 of the computer  
terminal A determines that the transmission request  
5 for the file has been received by the computer  
terminal B, text data of the file is divided into  
packets. The packet data is transmitted to the  
communication control unit 104 of the computer  
terminal B.

10 In the computer terminal B, the text data of  
the file received thereby is saved in a directory  
which has been prepared as a directory for received  
files in the file storage unit 103. The file storage  
unit 103 automatically sets a file name, such as  
15 "RECEIVED FILE DATA & TIME", which identifies the  
received file, and assigns the file name to the  
received file. After the communication control unit  
104 receives the file, the communication control unit  
104 supplies to the input event simulating unit 108  
20 completion information indicating that the file having  
the pass name set as the parameter has been received.  
The input event simulating unit 108 which receives the  
completion information of the reception of the file  
simulates an event corresponding to the "OPEN FILE"  
25 command. The application executing unit 105 opens the  
file stored in the file storage unit 103 in accordance  
with the event which is simulated by the input event  
simulating unit 108. Contents of the opened file are  
displayed on the display unit 102.

30 As the result of the above process, the  
contents of the same file is displayed on the display  
units of both the computer terminals A and B.

In this state, when an key operation is  
performed in the computer terminal A to input  
35 characters which should be inserted in the text (input  
of an event), the event executing unit 105 of the  
computer terminal A executes a process based on the

1 input event in accordance with the application of the  
word processor. As a result, characters are inserted  
at pointed positions in the text displayed on the  
display unit 102. At this time, also, a process is  
5 performed in accordance with a procedure shown in Fig.  
8.

Referring to Fig. 8, the input event copy  
unit 106 supplies to the input event analyzing unit  
107 key codes input by the keyboard. The input event  
10 analyzing unit 108 supplies to the communication  
control unit 104 a transmission request for the key  
code in accordance with the relationship shown in Fig.  
3. The communication control unit 104 transmits to  
the communication control unit 104 of the computer  
15 terminal B via the network the key codes which are  
supplied along with the transmission request.

In the computer terminal B, the key codes  
received by the communication control unit 104 are  
supplied to the input event simulating unit 108. The  
20 input event simulating unit 108 simulates the event so  
that the key codes have been just like input from the  
keyboard of the computer terminal B. The application  
executing unit 105 executes a process based on the  
simulated event in accordance with the application of  
25 the word processor. As a result, characters  
identified by the key codes are inserted at pointed  
positions in the text displayed on the display unit  
102. That is, the file in the computer terminal B is  
updated using characters input to the computer  
30 terminal A in the same manner as in the terminal A.

On the other hand, when a user inputs event  
information to the computer terminal B, the event  
information is simulated in the computer terminal A in  
the same manner as in the above case so that the same  
35 process as in the computer terminal B is performed in  
the computer terminal A.

Further, when, in computer terminal A or B,

1 a user clicks the mouse to select the icon "SAVE" or  
"PRINT", a process based on the event information  
corresponding the selected icon is performed in  
accordance with the application of the word processor.  
5 As a result, the file is saved in the filing device  
211, or the contents of the file is printed by the  
printer 204.

In this case, a process as shown in Fig. 9  
is also performed. That is, in a computer terminal in  
10 which the above event information ("SAVE" or "PRINT")  
is input, the event copy unit 106 copies the "SAVE"  
command or the "PRINT" command supplied from the input  
unit 101. The event copy unit 105 supplies to the  
input event analyzing unit 107 the event information  
15 having a pass name of the file as a parameter. The  
input event analyzing unit 107 terminates the process  
in accordance with the relationship shown in Fig. 3.  
As a result, the event information regarding the  
"SAVE" command and the "PRINT" command is not supplied  
20 to the communication control unit 104, so that the  
event information is supplied to another computer  
terminal. That is, in another computer terminal,  
processes for saving a file and for printing a file  
are not executed.

25 Thus, the processes regarding the "SAVE"  
command and the "PRINT" command are executed only in a  
terminal in which these command are input.

A description will now be given of another  
embodiment of the present invention.

30 In this embodiment, each computer terminal  
has a functional structure as shown in Fig. 10.  
Referring to Fig. 10, a computer terminal has the  
input unit 101, the display unit 102, the  
communication control unit 104 and the input event  
35 simulating unit 108 in the same manner as in the above  
embodiment. The computer terminal has also a floor  
control unit 121 and an input hook unit 122. The

1     input hook unit 122 may copy an input event or inhibit  
an input event from being supplied to an application.  
The input event simulating unit 108 simulates an event  
to be supplied to the application (the application  
5     executing unit 105). The floor control unit 121  
controls whether or not the computer terminal has the  
floor by which events are allowed to input to the  
computer terminal.

       In a primary computer terminal which is  
10    controlled by the floor control unit 121 so as to have  
the floor, an event input to the input unit 101 is  
supplied to the application executing unit 105 and is  
copied by the input hook unit 122. The event copied  
by the input hook unit 122 is supplied to the  
15    communication control unit 104. The communication  
control unit 104 transmits the copied event to a  
secondary computer terminal which is controlled by the  
floor control unit 121 so as to have no floor. In the  
secondary computer terminal, when the event  
20    transmitted from the primary computer terminal is  
received by the communication control unit 104, the  
input event simulating unit 108 simulates the event  
and supplies the simulated event to the application  
(the application executing unit 105). The application  
25    executing unit 105 performs a process based on the  
simulated event in accordance with the application.  
As a result, the same process is performed in both the  
primary computer terminal and the secondary computer  
terminal in accordance with the shared application.

30       When an event is input to the input unit 101  
of the secondary computer terminal having no floor,  
the input hook unit 122 inhibits the input event from  
being supplied to the application (the application  
executing unit 105). Thus, even if an event is  
35    supplied to a computer terminal having no floor, a  
process based on the event is not performed in the  
computer terminal.

1        Each computer terminal may be provided with  
an input mode setting unit 123 and a drawing unit 124  
as shown in Fig.11.

5        Referring to Fig. 11, the input unit 101 has  
a pointing device for pointing a position on the  
display unit 102. When the pointing device points a  
position on the display unit 101, the input unit 101  
generates an event corresponding to the pointed  
position. The input mode setting unit 123 sets an  
10    operation mode which is an normal mode or a drawing  
mode. The drawing unit 124 draws a picture on the  
display unit 102 in accordance with pointed position  
information from the pointing device of the input unit  
101.

15        When the primary computer terminal is set in  
the normal mode by the input mode setting unit 123, an  
event corresponding to a position pointed on the  
display unit 102 by the pointing device is supplied  
from the input unit 101 to the application executing  
20    unit 105 and the input hook unit 122. The application  
executing unit 105 executes a process based on the  
event in accordance with the application. The input  
hook unit 122 copies the event and the copied event is  
transmitted from the communication control unit 104 to  
25    the secondary computer terminal. In the secondary  
computer terminal, the input event simulating unit 108  
simulates the received event and supplies it to the  
application (application executing unit 105). As a  
result, the application is executed in the secondary  
30    computer terminal in the same manner as in the primary  
computer terminal.

      In a case where the primary computer  
terminal is set in the drawing mode by the drawing  
unit 124, the pointed position information from the  
35    pointing device which points a position on a screen  
formed on the display unit based on the application is  
inhibited from being supplied to the application by

1 the hook unit 122. The drawing unit 124 draws a  
picture based on the pointed position information on  
the display unit 102. The pointed position  
information is transmitted from the communication  
5 control unit 104 to the secondary computer terminal.  
In the secondary computer terminal, the pointed  
position information is received, the drawing unit 124  
draws a picture based on the pointed position  
information on the display unit 102.

10 As a result, based on the pointed position  
information obtained by the primary computer terminal,  
the same picture is drawn on the display units in both  
the primary computer terminal and the secondary  
computer terminal.

15 A detailed description will now be given of  
operations of the system.

A startup operation in the application  
sharing system is performed in accordance with a  
procedure as shown in Fig. 12. A calling computer  
20 terminal is defined as the primary computer terminal  
and a called computer terminal is defined as the  
secondary computer terminal. In Fig. 12, means  
inputs from a user, means inputs from the network,  
means outputs on the display unit and means outputs  
25 to the network. Hereinafter, these symbols have the  
same meanings in Figs. 13, 14, 16 and 17. The  
application sharing system is formed as shown in Fig.  
1 and the hardware of each computer terminal is formed  
as shown in Fig. 4.

30 Referring to Fig. 12, in the primary  
computer terminal which is in an initial state (S00),  
when the hand set 214 is off-hooked, an initial screen  
as shown in Fig. 18 is automatically displayed on the  
display device 205. On the initial screen, a list of  
35 applications which can be shared by a plurality of  
users (computer terminals) and a telephone number list  
indicating telephone numbers for users by which an

1 application can be shared (S11). In this state, the  
mouse 209 is operated so that a pointer is positioned  
on the name of an application and the mouse 209 is  
double-clicked so that the application pointed by the  
5 pointer is selected. After this, the pointer is set  
on a user name in the telephone number list and the  
mouse 209 is double-clicked to select the user with  
who a user of the primary computer terminal should  
share the application. When the selection of the  
10 application and the user is completed, the primary  
computer terminal transmits to the secondary computer  
terminal of the selected user an audio channel  
connecting request. After this, the primary terminal  
becomes in a state of waiting for line connection  
15 (S12).

In the secondary terminal which is in the  
initial state (S00), when the audio channel connecting  
request is received, a ringing tone signal is  
generated and a screen as shown in Fig. 19 is  
20 displayed on the display device 205. After this, the  
secondary computer terminal becomes in a state of  
waiting for a response from the user (S21). On the  
screen, the name of a calling user, the name of an  
application to be shared and dialog boxes "ANSWER" and  
25 "REJECT". In this state, when the user of the  
secondary computer terminal selects the dialog box  
"ANSWER" using the mouse 209 or when the user raises  
the hook switch 215 of the hand set 214, the secondary  
computer terminal transmits a reception signal of the  
30 audio channel connecting request to the primary  
computer terminal. As a result, the system becomes in  
a state where conversation can be carried out using  
the hand sets 214 between the primary computer  
terminal and the secondary computer terminal.

35 After the primary computer terminal and the  
secondary computer terminal are connected by the audio  
channel as has been described above, the primary



1 computer terminal outputs a connecting request of the  
data line. The primary computer terminal then becomes  
in a state of waiting for a call for data (S13). The  
secondary computer terminal has become in a state of  
5 waiting for a call for data after the secondary  
computer terminal has been connected to the primary  
computer terminal by the audio channel (S22). In this  
state, when the secondary computer terminal receives  
the call for data from the primary computer terminal,  
10 the secondary computer terminal returns a response to  
the primary computer terminal.

After the primary computer terminal receives  
the response from the secondary, the primary computer  
terminal and the secondary computer terminal are  
15 connected by the data line. The primary computer  
terminal then transmits a name of an application to be  
shared to the secondary computer terminal. After  
this, the primary computer terminal becomes in a state  
of waiting to confirm whether the secondary computer  
20 terminal has the application to be shared (S14). The  
secondary computer terminal has become in a state of  
waiting to receive the name of the application after  
returning the response (S23). In this state, when the  
secondary computer terminal receives the name of the  
25 application from the primary computer terminal, the  
secondary computer terminal determines whether the  
application requested by the primary computer terminal  
is provided therein. In a case where the secondary  
computer terminal has the application requested by the  
30 primary computer terminal, an operating environment  
file of the application is stored as a temporary file  
in the secondary computer terminal. A message  
indicating that the application to be shared is  
provided in the secondary computer terminal is  
35 transmitted from the secondary computer terminal to  
the primary computer terminal. At this time, the  
secondary computer terminal becomes in a state of

1     waiting to receive the operating environment file  
      (S24).

      The primary computer terminal which receives  
      the message transmits the operating environment file  
5     of the application to be shared to the secondary  
      computer terminal. In the operating environment file,  
      for example, types of fonts used in the primary  
      computer terminal, font sizes, customized menu and the  
      like are defined. After transmitting the operating  
10    environment file, the primary computer terminal  
      becomes in a state of waiting for confirmation that  
      the secondary computer terminal receives the operating  
      environment file (S15).

      When the secondary computer terminal  
15    receives the operating environment file from the  
      primary computer terminal, the operating environment  
      file which has been stored as the temporary file is  
      saved at a predetermined storing position so as to be  
      changed to the operating environment file transmitted  
20    from the primary computer terminal. The secondary  
      computer terminal then transmits to the primary  
      computer terminal information indicating that the  
      operating environment file from the primary computer  
      terminal has received. After this, the application to  
25    be shared and a sharing agent are activated in the  
      secondary computer terminal. The sharing agent  
      activated in the secondary computer terminal has a  
      floor control function for controlling the presence or  
      absence of the floor of the application, a setting  
30    function for setting the operating mode (the drawing  
      mode or the normal mode), an input hook function for  
      inhibiting an event from being supplied to the  
      application and for copying an event and an input  
      event simulating function for simulating an input  
35    event.

      Further, when the primary computer terminal  
      receives the information indicating that the secondary

1 computer terminal has received the operating  
environment file, the application to be shared and the  
sharing agent are activated in the primary computer  
terminal. In this state, the application to be shared  
5 can be executed in the same operating environments in  
both the primary computer terminal and the secondary  
computer terminal (a sharing state Sc). When the user  
of the primary computer terminal performs an on-hook  
operation of the hand set 214, the audio channel  
10 between the primary computer terminal and the  
secondary computer terminal is disconnected. The  
sharing agent in the primary computer terminal has the  
floor control function for controlling the presence  
and absence of the floor, the setting function for  
15 setting the operating mode (the drawing mode and the  
normal mode), a function for inputting a scrolling  
request, a function for inputting a size of a window  
and a function for inputting a position of a window.

The sharing agent in the primary computer  
20 terminal initially sets the floor in the "presence"  
state and sets the operating mode in the "normal  
mode". The sharing agent in the secondary computer  
terminal initially sets the floor in the "absence"  
state and sets the operating mode in the "drawing  
25 mode". In the initial state, an event input to the  
secondary computer terminal is inhibited from being  
supplied to the application by the input hook  
function. Input buttons on the control panel  
displayed on the display device 205 are in an inactive  
30 state.

For example, in a case where a word  
processor application is shared by the primary  
computer terminal and the secondary computer terminal,  
the display screens in the respective computer  
35 terminals are formed as shown in Figs. 20A and 20B.  
Fig. 20A shows the display screen of the primary  
computer terminal, and Fig. 20B shows the display

1 screen of the secondary computer terminal. In Figs.  
20A and 20B, areas surrounded by thick lines are  
windows for the word processor application. The  
control panel is located at an upper side of each of  
5 the windows. A scroll bar and a size changing bar are  
respectively is located at a lower side and a right  
side of each of the windows for the word processor  
application. The control panel, the scroll bar and  
the size changing bar are controlled by the sharing  
10 agent in each of the computer terminal so as to be  
displayed in a state where they are in contact with  
the window.

The control panel indicates the state of the  
application and buttons for switching the presence and  
15 absence of the floor and the operating mode. Until  
the applications in both the primary computer terminal  
and the secondary computer terminal mutually detects  
that the other applications are in the active state,  
"INITIALIZING" is displayed as the state of the  
20 application on the control panel as shown in Figs. 20A  
and 20B.

The control panel has an "APPLICATION"  
button, a "DRAWING" button, a "DELETE" button, a  
"DRAWING TOOL" button and a "GET FLOOR" button. The  
25 control panel may be provided with one or more other  
buttons. The "APPLICATION" button is used to set the  
normal mode as the operating mode. When the  
"APPLICATION" button is selected by the click of the  
mouse 209, the normal mode is set as the operating  
30 mode. The "DRAWING" button is used to set the drawing  
mode as the operating mode. When the "DRAWING" button  
is selected by the click of the mouse 209, the drawing  
mode is set as the operating mode. The "DELETE"  
button is activated in the drawing mode. The "DELETE"  
35 button is used to delete images drawn in the window  
for the application. The "DRAWING TOOL" button used  
to set the thickness of lines and colors of lines.

1           The scroll bar located in the right side of  
the window for the application is provided with an up  
scroll button and a down scroll button. The up scroll  
button is used to scroll the screen upward and the  
5       down scroll button is used to scroll the screen  
downward. The scroll bar located in the lower side of  
the window is provided with a left scroll button and a  
right scroll button. The left scroll button is used  
to scroll the screen leftward and the right scroll  
10       button is used to scroll the screen rightward.

          The control panel, the scroll bars and the  
size changing bar are adjacent to the window under the  
control of the sharing agent. In the primary computer  
terminal having the floor, it is possible to scroll  
15       the screen and to changing the size of the window by  
operating the buttons in the windows. Thus, it may be  
not necessary to provide the scroll bars and the size  
changing bar around the window.

          The state of the sharing agent in the  
20       primary computer terminal is changed in accordance  
with the state transition diagram shown in Fig. 13.  
The state of the sharing agent in the secondary  
computer terminal is changed in accordance with the  
state transition diagram shown in Fig. 14.

25       In the primary computer terminal, when the  
sharing agent which is in the initial state (S10)  
confirms that the application has been activated, the  
sharing agent transmits to the sharing agent in the  
secondary computer terminal a confirmation message  
30       that the application has been activated.

          In the secondary computer terminal, when the  
sharing agent which is in the initial state (S20)  
confirms that the application has been activated, the  
sharing agent becomes in a state of waiting for the  
35       confirmation message (S201). In this state, when the  
sharing agent in the secondary computer terminal  
receives the confirmation message from the primary

1 computer terminal, the sharing agent confirms that the  
application has been activated in the primary computer  
terminal. "FLOOR ABSENCE" is displayed on the control  
panel and the control buttons on the control panel are  
5 made active. A confirmation response message is  
transmitted to the sharing agent in the primary  
computer terminal.

In the primary computer terminal, the  
sharing agent becomes in a state of waiting for the  
10 confirmation that the application has been activated  
in the secondary computer terminal after transmitting  
the confirmation message (S101). In this state, when  
the sharing agent receives the confirmation response  
message from the secondary computer terminal, "FLOOR  
15 PRESENCE" is displayed on the control panel and the  
state where events is inhibited from being supplied to  
the application is canceled. Further, the control  
buttons on the control panel are made active. As a  
result, the screens of the primary computer terminal  
20 and the secondary computer terminal are respectively  
updated as shown in Figs. 21A and 21B.

In the primary computer terminal, when a  
file menu of the application is selected and a text to  
be displayed is further selected, the text is  
25 transmitted from the primary computer terminal to the  
secondary computer terminal. As a result, the text is  
opened under the applications in both the primary  
computer terminal and the secondary computer terminal,  
so that the screens of the primary computer terminal  
30 and the secondary computer terminal are respectively  
changed as shown in Figs. 22A and 22B.

In the state as described above, the sharing  
agent in the primary computer terminal is in the  
normal mode shown in Fig. 13, and the sharing agent in  
35 the secondary computer terminal is in the drawing mode  
shown in Fig. 14.

In this state, inputs (events) from the

1 mouse 209 and the keyboard 207 are supplied to the  
application in the primary computer terminal so that  
processes are performed in accordance with the inputs.  
That is, the text opened under the application in the  
5 primary computer terminal is edited in accordance with  
the inputs from the mouse 209 and the keyboard 207.  
In addition, the inputs from the mouse 209 and the  
board 207 are copied by the input event copy function  
of the sharing agent. The copied inputs (events) are  
10 transmitted from the primary computer terminal to the  
secondary computer terminal via the network.

In the secondary computer terminal, due to  
the input hook function of the sharing agent, a mouse  
pointer is indicated, based on the received input  
15 information regarding the mouse 209, at a position on  
the window corresponding to a position at which a  
mouse cursor is indicated in the primary computer  
terminal. Further, due to the input simulating  
function of the sharing agent, inputs to the  
20 application are simulated based on the received input  
information from the keyboard 207 in the primary  
computer terminal, so that the text is edited under  
the application in the secondary computer terminal in  
the same manner as in the primary computer terminal.

25 In the secondary computer terminal which is  
in the state of "FLOOR ABSENCE", an input operation of  
the keyboard 207 is performed, the input hook function  
of the sharing agent inhibits the keyboard input  
information from being supplied to the application.  
30 The input hook function may be realized, for example,  
by an input device driver or an API of the window  
system.

In the secondary computer terminal in which  
the drawing mode is set, when an input operation of  
35 the mouse 209 is performed, the input hook function of  
the sharing agent inhibits the mouse input information  
from being supplied to the application. The sharing

1 agent preforms the drawing process, based on the mouse  
input information which is inhibited from being  
supplied to the application, in the window for the  
application. A drawing instruction is then  
5 transmitted from the secondary computer terminal to  
the primary computer terminal via the network. As a  
result, the same drawing process as in the secondary  
computer terminal is performed in the primary computer  
terminal.

10 In the primary computer terminal, when the  
"DRAWING" button is operated by the click of the mouse  
209, the operating mode of the sharing agent is  
switched from the normal mode to the drawing mode (see  
Fig. 13). In this state, when the input operation of  
15 the mouse 209 is performed in the primary computer  
terminal, the input hook function of the sharing agent  
inhibits the mouse input information from being  
supplied to the application. Based on the mouse input  
information, the same drawing process is executed on  
20 the windows in both the primary computer terminal and  
the secondary computer terminal in the same manner in  
the case described above.

Figs. 23A and 23B respectively show display  
screens in the primary computer terminal and the  
25 secondary computer terminal in a case where the input  
operation of the mouse 209 is performed in the  
secondary computer terminal. The windows for the  
application (the word processor) are formed at  
positions on the screens in the primary computer  
30 terminal and the secondary computer terminal. In the  
secondary computer terminal, when the mouse cursor is  
moved on the screen while the mouse button is being  
held down (the drag), a line drawing is formed on the  
screen so as to trance the movement of the mouse  
35 cursor. In the primary computer terminal, a mouse  
pointer corresponding to the mouse cursor in the  
secondary computer terminal moves on the screen in the



1 same manner as the mouse cursor. As a result, a line  
drawing is formed on the screen in the window for the  
application so as to trace the movement of the mouse  
pointer.

5 In the secondary computer terminal, when the  
"GET FLOOR" button is selected by the click of the  
mouse 209, the floor request message is transmitted  
from the sharing agent in the secondary computer  
terminal to the sharing agent in the primary computer  
10 terminal. The sharing agent in the secondary computer  
terminal becomes in a state of waiting for a response  
to the floor request message (S202 in Fig. 14).

When the floor request message is received  
in the primary computer terminal, the "GET FLOOR"  
15 button is activated. "FLOOR PRESENCE" displayed on  
the control panel is then changed to "FLOOR ABSENCE".  
The inputs are inhibited from being supplied to the  
application, and the response message to the floor  
request message is transmitted from the primary  
20 computer terminal to the secondary computer terminal.

When the sharing agent in the secondary  
computer terminal receives the response message from  
the primary computer terminal, the "GET FLOOR" button  
is inactivated. "FLOOR ABSENCE" displayed on the  
25 control panel is then changed to "FLOOR PRESENCE".  
The state where the inputs are inhibited from being  
supplied to the application is canceled.

The sharing agent in the terminal which  
obtains the floor is automatically set in the normal  
30 mode, and the sharing agent in the terminal which  
releases the floor is automatically set in the drawing  
mode.

In the above embodiment, when the "GET  
FLOOR" button is selected by the click of the mouse  
35 209, the presence and the absence of the floor is  
switched in the system. On the other hand, the  
operating request message may be automatically

1       transmitted from the secondary computer terminal when  
the input hook function of the sharing agent in the  
secondary computer terminal inhibits an event from  
being supplied to the application.

5       In a case where a user of a computer  
terminal having no floor desires to scroll a display  
screen in the other computer terminal, the scroll bar  
adjacent to the window for the application in the  
computer terminal is operated. In this case, when the  
10       scroll bar is operated, a scroll instruction occurs.

For example, when the scroll button of the  
scroll bar adjacent to the window for the application  
(the word processor) in the secondary computer  
terminal is operated by click of the mouse, a scroll  
15       request message is transmitted to the sharing agent of  
the primary computer terminal. When the sharing agent  
of the primary computer terminal receives the scroll  
request message, the event simulating function is  
activated. As a result, a scroll instruction is  
20       simulated by the event simulating function. Based on  
the simulated scroll instruction (a scroll instruction  
event), the screen in the window for the application  
in the primary computer terminal is scrolled.

The input hook function of the sharing agent  
25       in the primary computer terminal detects the simulated  
scroll instruction (the scroll instruction event), and  
transmits the scroll instruction event to the  
secondary computer terminal. When the secondary  
computer terminal receives the scroll instruction  
30       event from the primary computer terminal, the scroll  
instruction event is supplied to the application. As  
a result, the screen in the window for the application  
in the secondary computer terminal is scrolled in the  
same manner as in the primary computer terminal.

35       In a general window system, the mouse is  
dragged while pointing a frame of a window to change a  
position of the window, and the mouse is clicked while

1 pointing a size changing button on the frame of a  
window to changing the size of the window.

In a case where such system is used for  
computer terminals, when the size of a window for the  
5 application in the primary computer terminal is  
changed, a window information supply unit supplies to  
the sharing agent information indicating that the size  
of the window has been changed. The window  
information supply unit may be realized using the API  
10 of the window system. The size of the window may be  
checked in predetermined intervals using a timer.  
When the sharing agent is informed that the size of  
the window has been changed, a changing message that  
the size of the window has been changed is transmitted  
15 from the sharing agent in the primary computer  
terminal to the sharing agent in the secondary  
computer terminal. When the sharing agent in the  
secondary computer terminal receives the changing  
message, a window state setting unit of the sharing  
20 agent in the secondary computer terminal changes the  
size of a window for the application in the secondary  
computer terminal in accordance with the changing  
message. The window state setting unit may be  
realized by the API of the window system.

25 On the other hand, since events are  
inhibited from being supplied to the application in  
the secondary computer terminal, the size and the  
position of the window for the application in the  
secondary computer terminal cannot be directly changed  
30 by input of events. Thus, the size and the position  
of the window is indirectly controlled by using the  
control panel, the scroll bar and the size changing  
bar located around the window.

On the screen of the display device 205 in  
35 the secondary computer terminal, when the control  
panel is moved by drag of the mouse 209, for example,  
as shown in Fig. 24A, the window for the application

1       and the scroll bar and the size changing bar are moved  
as shown in Fig. 24B. After moving the control panel,  
the scroll bar, the size changing bar and the window,  
a state where the control panel, the scroll bar and  
5       the size changing bar are located around the window is  
maintained.

A process for moving the window as described  
above is performed in accordance with the following  
procedure.

10       When the control panel is moved by the drag  
of the mouse, a window operation informing unit  
informs the sharing agent that the control panel has  
been moved. The window setting unit of the sharing  
agent then moves the window so that coordinates of a  
15       left upper corner point of the window is equal to  
coordinates of a left lower corner point of the moved  
control panel. After this, the scroll bar and the  
size changing bar are respectively moved to the right  
side and the lower side of the moved window. The  
20       window operation informing unit and the window setting  
unit may be realized by the API of the window system.

On the screen of the display device 205 in  
the secondary computer terminal, when the size bar  
adjacent to the window for the application is operated  
25       by the drag of the mouse as shown in Fig. 25A, the  
size of the window and the sizes of the scroll bar and  
the control panel are changed as shown in Fig. 25B.

A process for changing the size of the  
window as described above is performed in accordance  
30       with the following procedure.

When the size changing bar is moved by the  
drag of the mouse, the window state informing unit  
supplies a position of the moved size changing bar to  
the sharing agent. The sharing agent changes the size  
35       of the window so that the right lower corner of the  
window is located at a position of the left upper  
corner of the size changing bar. Further, the sharing

1     agent changes the sizes of the control panel and  
scroll bar so that the control panel and the scroll  
bar are adjacent to the window for the application  
which size has been changed.

5             In cases where the size changing bar is  
moved leftward from the left side of the window for  
the application and upward from the upper size of the  
window, the sharing agent does not change the size of  
the window for the application. In this case, the  
10    size changing bar is returned to an original position.

Windows (of the control panel, the scroll  
bar and the size changing bar) adjacent to the window  
for the application are used to change the position  
and the size of the window for the application in a  
15    state where events are inhibited from being supplied  
to the application. On the other hand, on the screen  
of the display device 205 in the primary computer  
terminal, when the size of the window for the  
application is moved as shown in Fig. 26A, the control  
20    panel, the scroll bar and the size changing bar are  
moved so as to be adjacent to the moved window as  
shown in Fig. 26B.

In addition, a general window system is  
provided with a maximizing button used to maximize the  
25    size of a window. When the maximizing button is  
operated by the click of the mouse, the window is  
expanded to an entire screen of the display device.  
In this case, the screen has no space for the control  
panel, the scroll bar and the size changing bar which  
30    are to be located around the window. To avoid this  
state, when the sharing agent detects an event to  
maximize the size of the window, the sharing agent  
instructs the window setting unit that the window is  
expanded to a size slightly smaller than the maximum  
35    size. As result, when the maximizing button is  
operated, the window is expanded to a size slightly  
smaller than the maximum size so that the control

1 panel, the scroll bar and the size changing bar are  
displayed with the window on the screen of the display  
device, as shown in Fig. 27.

Further, a general window system is provided  
5 with a button used to change a window to an icon.  
When this button is operated by the click of the  
mouse, a window is changed to an icon on the screen.  
In this case, the control panel, the scroll bar and  
the size changing bar which were located around the  
10 window remain on the screen as shown in Fig. 28. To  
avoid this state, when sharing agent detects an event  
to change a window for the application to an icon, the  
control panel, the scroll bar and the size changing  
bar are changed to a predetermined icon. The control  
15 panel, the scroll bar and the size changing bar may be  
deleted from the screen.

In addition, when a button is operated by  
the click of the mouse to change the icon back to the  
window, the sharing agent detects an event  
20 corresponding to the operation of the button. The  
sharing agent then changes the other icons back to the  
control panel, the scroll bar and the size changing  
bar such that the control panel, the scroll bar and  
the size changing bar are adjacent to the window for  
25 the application.

Further, the icons may be changed back to  
the control panel, the scroll bar and the size  
changing bar before the icon is changed back to the  
window for the application. In this case, when the  
30 icons are changed back to the control panel, the  
scroll bar and the size changing bar, the icon is  
automatically changed back to the window for the  
application so that the window, the control panel, the  
scroll bar and the size changing bar are integrated  
35 with each other.

When a close button of the window is  
operated, the window is deleted from the screen of the

1 display device. In this case, the sharing agent  
detects an event corresponding to the operation of the  
close button, and the control panel, the scroll bar  
and the size changing bar are deleted from the screen  
5 by control of the sharing agent. The linkage between  
the sharing agents in both the primary computer  
terminal and the secondary computer terminal is then  
disconnected.

As has been described above, the windows (of  
10 the control panel, the scroll bar and the size  
changing bar) which are displayed by the control of  
the sharing agent and the window for the application  
are controlled so as to be always integrated with each  
other. Thus, in a case where a plurality of  
15 applications are shared by a plurality of user  
computer terminals, users can easily determine, on the  
screens, which windows displayed by the control of the  
sharing agents correspond to the respective windows  
for the applications.

20 In a case of a commercially available  
application which is shared by user computer  
terminals, even if the same operation environments are  
set in both the primary computer terminal and the  
secondary computer terminal and an event input to the  
25 primary computer terminal is simulated in the  
secondary computer terminal, there is a case where the  
same result is not obtained in both the primary  
computer terminal and the secondary computer terminal.  
In this case, it is necessary to inhibit an event from  
30 being the supplied to the shared application.  
However, although a window for the application can be  
scrolled and the drawing on the window can be  
performed, a process (e.g., a text editing process)  
corresponding to the event which is inhibited from  
35 being supplied to the shared application is not  
carried out. Thus, a suspension/resumption button is  
provided in the control panel as shown in Fig. 15.

1           The state transition of the primary computer  
terminal in a process corresponding to the  
suspension/resumption button is shown in Fig. 16. The  
state transition of the secondary computer terminal in  
5   the process corresponding to the suspension/resumption  
button is shown in Fig. 17.

          In the primary computer terminal, the  
suspension/resumption button is usually indicated as  
"SUSPEND" so as to function as a suspension button.  
10   When the suspension button is operated by the click of  
the mouse, an event corresponding to an suspension  
process occurs and a state where an event is inhibited  
from being supplied to the application is released.  
At this time, the indication of the  
15   suspension/resumption button is changed from the  
"SUSPEND" to "RESUME" (a RESUME button), so that the  
primary computer terminal is in a state where when the  
suspension/resumption button is operated by the click  
of the mouse, an event corresponding to a restart  
20   process occurs. A suspension request message is then  
transmitted from the primary computer terminal to the  
secondary computer terminal.

          On the screen of the display device in the  
secondary computer terminal, a message indicating that  
25   a state where the application which is commercially  
available is shared is suspended in the other computer  
terminal (the primary computer terminal) is displayed.  
The floor button is in an inactive state. During this  
state, events input to the primary computer terminal  
30   are not transmitted to the secondary computer  
terminal. In this state, the primary computer  
terminal carries out a process (e.g., a text editing  
process) corresponding to an event supplied to the  
application.

35           In the primary computer terminal, when the  
restart button is operated by the click of the mouse,  
the sharing agent simulates a file save command and



1 supplies the simulated file save command to the  
application. As a result, in accordance with the  
application, a file which has been made in a  
suspension state is saved. When the file is  
5 completely saved in the primary computer terminal, the  
file is transmitted from the primary computer terminal  
to the secondary computer terminal.

The sharing agent in the secondary computer  
terminal simulates an event for request to open the  
10 received file, and the floor button on the control  
panel is activated. A resume completion message is  
then transmitted from the secondary computer terminal  
to the primary computer terminal.

When the primary computer terminal receives  
15 the resume completion message, the state where events  
are inhibited from being supplied to the application  
is released, and the indication of the  
suspension/resumption button on the control panel is  
changed from the "RESUME" to "SUSPEND".

20 As has been described above, a state where  
an application which is commercially available is  
shared by the primary computer terminal and the  
secondary computer terminal is released, and a file  
which is made in the primary computer terminal in  
25 accordance with an event supplied thereto is  
transmitted to the secondary computer terminal. Thus,  
even if an event by which the primary computer  
terminal and the secondary computer terminal are not  
operated under the same operating environments is  
30 supplied to the primary computer terminal, results of  
processes in accordance with the events in the primary  
computer terminals and the secondary computer  
terminals can be equal to each other. After the file  
is transmitted from the primary computer terminal to  
35 the secondary computer terminal, due to the resume  
process, a state where the application which is  
commercially available is shared by the primary

1 computer terminal and the secondary computer terminal  
can be restarted.

Although the suspension/resumption process  
cannot be requested in the secondary computer terminal  
5 having no floor in the above embodiment, a system in  
which that can be requested in the secondary computer  
terminal can be formed.

In addition, the function for drawing lines  
on the window for the application can be provided in a  
10 computer terminal, not connected to the network, in  
which processes are executed in accordance with a  
general-purpose application.

The present invention is not limited to the  
aforementioned embodiments, and variations and  
15 modifications may be made without departing from the  
scope of the claimed invention.

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1     WHAT IS CLAIMED IS:

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1. An application sharing system in which a plurality of computer terminals are connected to a network, a shared application which is commercially available being installed in said plurality of computer terminals, when an event is input to a computer terminal, a process corresponding to the event being performed in accordance with the shared application in the computer terminal and in other computer terminals, each of said plurality of computer terminal comprising:

event determination means for determining what an input event is;

file transmission means, when said event determination means determines that the input event is an open command for a file, for transmitting the file to another computer terminal;

received file managing means for receiving and managing the file which is transmitted based on an open command in another computer terminal; and

event simulating means, when the file is transmitted based on an open command in another computer terminal, for simulating an event corresponding to an open command for opening the file which is managed by the received file managing means in the shared application.

2. The application sharing system as claimed in claim 1, wherein said received file managing means has file storage means for storing the

1     received file in a directory set by a user.

5

3. The application sharing system as  
claimed in claim 1, wherein each of said plurality of  
computer terminals further comprises:

10         means, when said event determination means  
determines that the input event is a save command for  
the file, for inhibiting the save command from being  
supplied to another computer terminal.

15

4. The application sharing system as  
claimed in claim 1, wherein each of said plurality of  
computer terminals further comprises:

20         means, when said event determination means  
determines that the input event is a print command for  
the file, for inhibiting the print command from being  
supplied to another computer terminal.

25

5. An application sharing system in which a  
plurality of computer terminals are connected to a  
30     network, a shared application which is commercially  
available being installed in said plurality of  
computer terminals, when an event is input to a  
computer terminal, a process corresponding to the  
event being performed in accordance with the shared  
35     application in the computer terminal and in other  
computer terminals, each of said plurality of computer  
terminals comprising:

1           event determination means for determining  
what an input event is; and  
          means, when said event determination means  
determines that the input event is a save command for  
5   a file, for inhibiting the save command from being  
supplied to another computer terminal.

10

6. The application sharing system as  
claimed in claim 5, wherein each of said plurality of  
computer terminals further comprises:  
          means, when said event determination means  
15 determines that the input event is a print command for  
the file, for inhibiting the print command from being  
supplied to another computer terminal.

20

7. An application sharing system in which a  
plurality of computer terminals are connected to a  
network, a shared application which is commercially  
25 available being installed in said plurality of  
computer terminals, when an event is input to a  
computer terminal, a process corresponding to the  
event being performed in accordance with the shared  
application in the computer terminal and in other  
30 computer terminals, each of said plurality of computer  
terminal comprising:

          event determination means for determining  
what an input event is; and  
          means, when said event determination means  
35 determines that the input event is a print command for  
a file, for inhibiting the print command from being  
supplied to another computer terminal.

1           8. An application sharing system in which a  
shared application is executed in a plurality of  
computer terminals which are connected to a network,  
the shared application being commercially available,  
5 each of said plurality of computer terminals  
comprising:

input hook means for copy an input event and  
for inhibiting the input event from being supplied to  
the shared application;

10 input event simulating means for simulating  
an input event to be supplied to the shared  
application;

floor control means for controlling presence  
and absence of a floor based on which an event is  
15 accepted; and

communication control means for transmitting  
information to other computer terminal via the  
network, wherein an event input to a first computer  
terminal which is set in a state of the presence of  
20 the floor by said floor control means is supplied to  
the shared application and copied by said input hook  
means, said communication control means transmitting  
the copied event to a second computer terminal which  
is set in a state of the absence of the floor by said  
25 floor control means, and wherein when the event from  
said first computer terminal is received by said  
second computer terminal, said input event simulating  
means simulates the received event so that the shared  
application is executed based on the simulated event  
30 in the same manner as in said first computer terminal,  
an event input to said second computer terminal being  
inhibited from being supplied to the shared  
application by said input hook means.

1           9. The application sharing system as  
claimed in claim 8, wherein a floor request message  
which is output, based on an input operation of a  
user, from said floor control means of said second  
5 computer terminal is transmitted to said first  
computer terminal by said communication control means,  
wherein said floor control means of said first  
computer terminal which receives the floor request  
message sets said first computer terminal in a state  
10 of the absence of the floor and outputs an acceptance  
message of the floor request, the acceptance message  
being transmitted to said second computer terminal by  
said communication control means, and wherein said  
floor control means of said second computer terminal  
15 which receives the acceptance message sets said second  
computer terminal in a state of the presence of the  
floor.

20

          10. The application sharing system as  
claimed in claim 8, wherein when said input hook means  
of said second computer terminal detects an event  
25 which should be inhibited from being supplied to the  
shared application, a floor request message is  
transmitted to said first computer terminal by said  
communication control means, wherein said floor  
control means of said first computer terminal which  
30 receives the floor request message sets said first  
computer terminal in a state of the absence of the  
floor and an acceptance message of the floor request,  
the acceptance message being transmitted to said  
second computer terminal by said communication control  
35 means, and wherein said floor control means of said  
second computer terminal which receives the acceptance  
message sets said second computer terminal in a state

1 of the presence of the floor.

5

11. The application sharing system as  
claimed in claim 8, wherein at least said second  
computer terminal which is set in a state of the  
absence of the floor has scroll input means for  
10 inputting a scroll request for scrolling a screen for  
the shared application, wherein when the scroll  
request is input by said scroll input means, the  
scroll request is transmitted by said communication  
control means from said second computer terminal to  
15 said first computer terminal which is set in a state  
of the presence of the floor, wherein when said first  
computer terminal receives the scroll request, the  
scroll request is supplied to said shared application  
so that a scroll process in the shared application is  
20 performed, a scroll request being transmitted by said  
communication control means from said first computer  
terminal to said second computer terminal, and wherein  
when said second computer terminal receives the scroll  
request, a scroll process in the shared application is  
25 performed based on the scroll request.

30 12. The application sharing system as  
claimed in claim 8, wherein an operating environment  
file defining operating environments for the shared  
application is transmitted from said first computer  
terminal which is set in a state of the presence of  
35 the floor to said second computer terminal which is  
set in a state of the presence of the floor, and  
wherein the second computer terminal which receives



1     the operating environment file substitutes the  
received operating environment file for an original  
operating environment file.

5

13. The application sharing system as  
claimed in claim 1, wherein each of said plurality of  
10 computer terminals further comprises:

window size changing means, independent of  
the shared application, for changing a size of a  
window for the shared application; and

15 window size changing detecting means,  
independent of the shared application, for detecting  
that the size of the window is changed, and wherein  
said size changing detecting means detects that the  
size of the window is changed in one of said plurality  
of computer terminals, a changed size of the window is  
20 transmitted to the other computer terminal by said  
communication control means, and wherein when the  
other computer terminal receives the changed size of  
the window, said window size changing means changes a  
size of the window for the application so that the  
25 size is equal to the changed size of the window in the  
one of said plurality of computer terminals.

30

14. An application sharing system in which  
a shared application is executed in a plurality of  
computer terminals which are connected to a network,  
the shared application being commercially available,  
35 each of said plurality of computer terminals  
comprising:

pointing means, independent of the shared

1 application, for pointing a position on a screen of a  
display device;  
input hook means for copying an event  
occurring when a position on the screen is pointed by  
5 said pointing means and inhibiting pointed position  
information from said pointing means from being  
supplied to the shared application;  
mode setting means for setting an operating  
mode in a drawing mode or a normal mode;  
10 drawing means for drawing pictures on the  
screen based on the pointed position information from  
said pointing means;  
input simulating means for simulating events  
to be supplied to the shared application; and  
15 communication control means for transmitting  
information to other computer terminal via the  
network, wherein when a first computer terminal is set  
in the normal mode by said mode setting means, an  
event occurring based on a position which is pointed  
20 on the screen by said pointing means is supplied to  
the shared application and is copied by said input  
hook means, the event copied by said input hook means  
being transmitted to a second computer terminal by  
said communication control means, said input  
25 simulating means of said second computer terminal  
simulating the event from said first computer terminal  
so that the share application is executed in said  
second computer terminal in the same manner as in said  
first computer terminal, and wherein when said first  
30 computer terminal is set in the drawing mode by said  
mode setting means, pointed position information from  
said pointing means is inhibited from being supplied  
to the shared application and said drawing means draws  
pictures on the screen based on the pointed position  
35 information, the pointed position information being  
transmitted to said second computer terminal by said  
communication control means, said drawing means of

1     said second computer terminal which receives the  
pointed position information draws pictures on the  
screen based on the pointed position information.

5

15.   The application sharing system as  
claimed in one of claims 8 through 14, wherein each of  
10   said computer terminals further comprises:

      window size input means for specifying a  
size of the window for the shared application;

      window position input means for specifying a  
position of the window for the shared application; and

15       window state setting means, independent of  
the shared application, for setting a size and  
position of the window, and wherein said window state  
setting means changes the size and/or the position of  
the window based on the size and/or the position  
20   specified by said window size input means and/or said  
window position input means.

25

16.   The application sharing system as  
claimed in one of claims 8 through 14, wherein each of  
said computer terminals further comprises:

30       window state detecting means for detecting a  
size and a position of the window formed on the  
screen;

      window state setting means, independent of  
the shared application, for setting a size and a  
position of the window formed on the screen; and

35       control window forming means, independent of  
the shared application, for forming a control window  
for generating control events on the screen, wherein

1     when a position and/or a size of one of the window for  
the shared application and the control window is  
changed, said window state setting means sets sizes  
and positions of the window for the application and  
5     the control window based on sizes and positions of  
these windows detected by said window state detecting  
means so that these windows are adjacent to each  
other.

10

17. The application sharing system as  
claimed in claim 16, wherein the control window  
15     includes at least one of a window used to accept a  
setting request of the operating mode, a window used  
to accept a request of the floor, a window used to  
scroll the window for the shared application, a window  
used to specify a size of the window and a window used  
20     to specify a position of the window.

25     18. The application sharing system as  
claimed in claim 16, wherein each of said computer  
terminals further comprises:  
first window operation detecting means,  
independent of the shared application, for detecting  
30     that an operation for expanding the window for the  
share application to a full size on the screen is  
performed, wherein when said first window operation  
detecting means detects that the operation is  
performed, said window state setting means sets sizes  
35     of the respective windows so that the screen is  
entirely filled with the window for the shared  
application and control window adjacent to the window.

1           19. The application sharing system as  
          claimed in claim 16, wherein each of said computer  
          terminals further comprises:

          second window operation detecting means,  
5       independent of the shared application, for detecting  
          that an operation for changing the window for the  
          shared application to an icon is performed; and

          first widow changing means, independent of  
          the shared application, for changing the control  
10       window to an icon or deleting the control window,  
          wherein when said second window operation detecting  
          means detects that the operation is performed, said  
          window changing means changes the control window to  
          the icon or deletes the control window.

15

          20. The application sharing system as  
20       claimed in claim 19, wherein each of said computer  
          terminals further comprises:

          third widow operation detecting means,  
          independent of the shared application, for detecting  
          that an operation for changing the icon back to the  
25       window for the shared application is performed; and

          second window changing means, independent of  
          the shared application, for changing the icon back to  
          the control window or for reproducing the control  
          window from the deleted control window, wherein when  
30       said third window operation detecting means detects  
          that the operation is performed, said second window  
          changing means changes the icon back to control window  
          or reproduces the control window on the screen.

35

1           21. The application sharing system as  
claimed in claim 20, wherein when the control window  
is formed on the screen by said second window changing  
means before said third window operation detecting  
5 means detects that the operation is performed, said  
window state setting means sets a size and position to  
form the window for the application on the screen.

10

          22. The application sharing system as  
claimed in claim 16, wherein each of said computer  
terminal further comprises:  
15           application termination detecting means for  
detecting that a terminating operation of the share  
application is performed, wherein when said  
application termination detecting means of said first  
computer terminal detects that terminating operation  
20 is performed, the control window is deleted by said  
wind state setting means and a share terminating  
message is transmitted from a first computer terminal  
to a second computer terminal by said communication  
control means, and wherein in said second computer  
25 terminal which receive the share terminating message,  
the control window is deleted by said window state  
setting means and the share of the application is  
terminated.

30

          23. The application sharing system having  
all the limitations set forth in claims 8 and 14,  
35 wherein each of said plurality of computer terminals  
is set in the normal mode when having the floor, and  
wherein each of said plurality of computer terminals

1 is set in the drawing mode when releasing the floor.

5

24. The application sharing system as claimed in one of claims 8 and 14, each of said plurality of computer terminals further comprises:

sharing suspension/resumption means for  
10 suspending and resuming a sharing state of the application in the computer terminal, whereby when an instruction of suspension is supplied to a computer terminal, the sharing state of the application is suspended so that said computer terminals is in a  
15 state where any events are acceptable, and when an instruction of resumption is supplied to a computer terminal a command for saving a current file in the application is issued and the current file is transmitted to other terminal by said communication  
20 control means, a file open command being executed by said input simulating means in the other computer terminal so that the sharing state of the application resumed.

25

25. A system for executing an application which is commercially available, said system  
30 comprising:

pointing means, independent of the application, for pointing positions on a screen of a display unit;

input hook means for copying an event  
35 occurring when a position on the screen is pointed by said pointing means and inhibiting pointed position information from said pointing means from being

1     supplied to the application which is commercially  
available;

mode setting means for setting an operating  
mode in a drawing mode or a normal mode; and

5     drawing means, independent of the  
application, for drawing images on the screen based on  
the pointed position information from said pointing  
means, wherein when the normal mode is set as the  
operation mode, an event based on a position pointed  
10    by said pointing means is supplied to the application  
so that the application is executed based on the  
event, and wherein when the drawing mode is set as the  
operation mode, the pointed position information from  
said pointing means is inhibited from being supplied  
15    to the application by said input hook means and said  
drawing means draws images on the screen based on the  
pointed position information.

20

26. A system for executing an application which is  
commercially available, said system substantially as  
hereinbefore described with reference to and  
25    illustrating in accompanying drawings.

27. An application sharing system  
substantially as hereinbefore described with  
reference to the accompanying drawings.  
30

35



FIG. 1

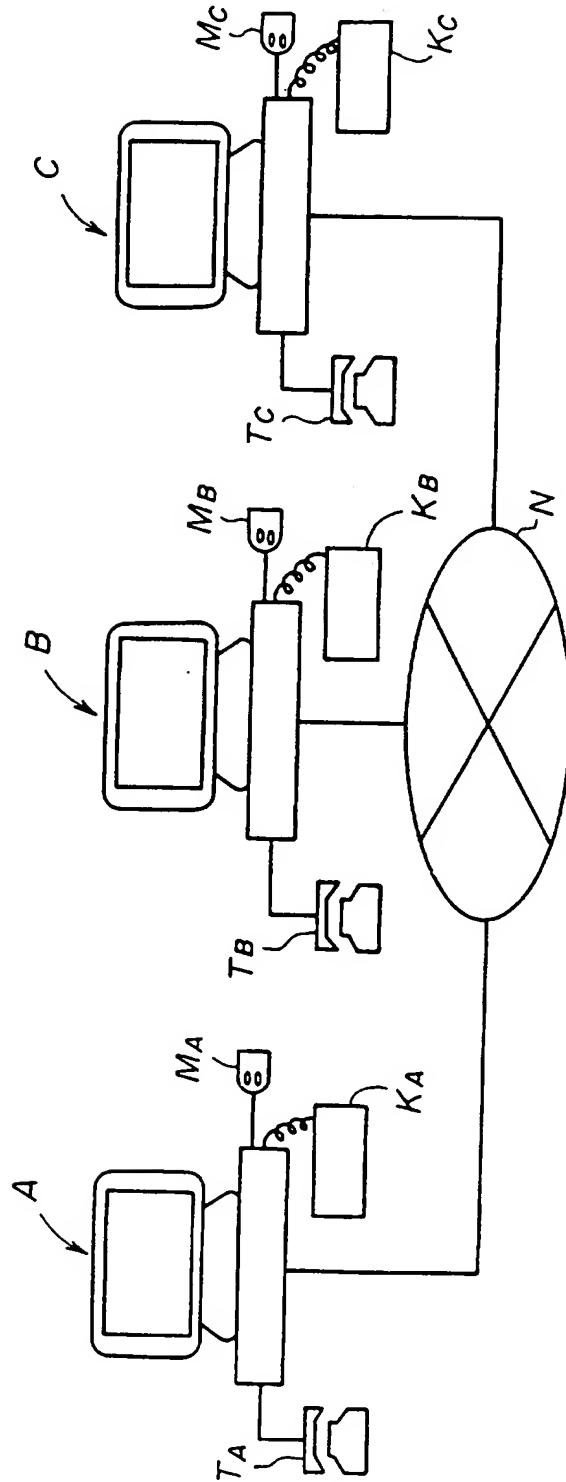


FIG. 2

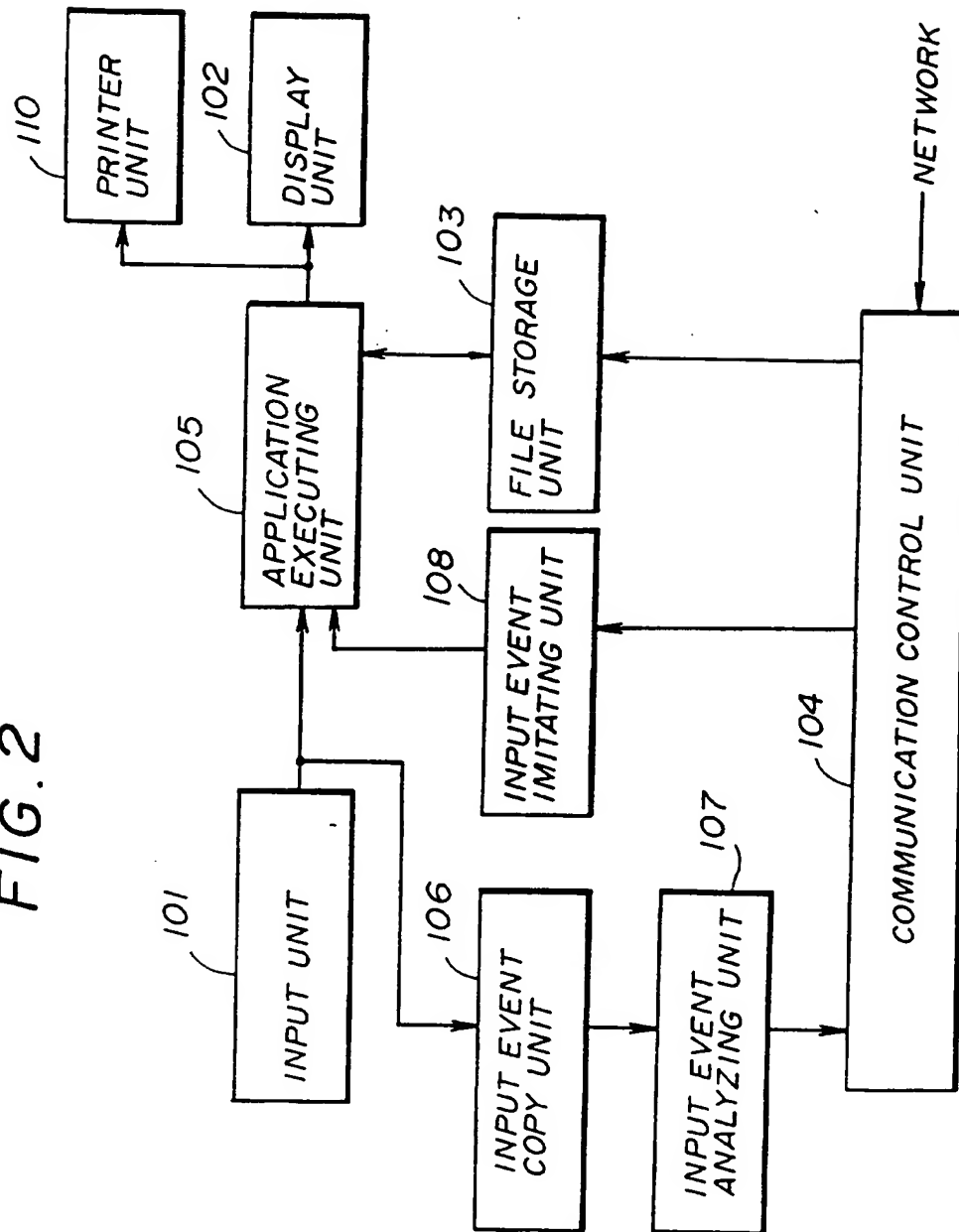


FIG. 3

| INPUT EVENT       | PROCESS                           |
|-------------------|-----------------------------------|
| FILE OPEN COMMAND | TRANSMISSION OF FILE              |
| PRINT COMMAND     | TERMINATION                       |
| FILE SAVE COMMAND | TERMINATION                       |
| OTHER EVENTS      | TRANSMISSION OF EVENT INFORMATION |

FIG. 4

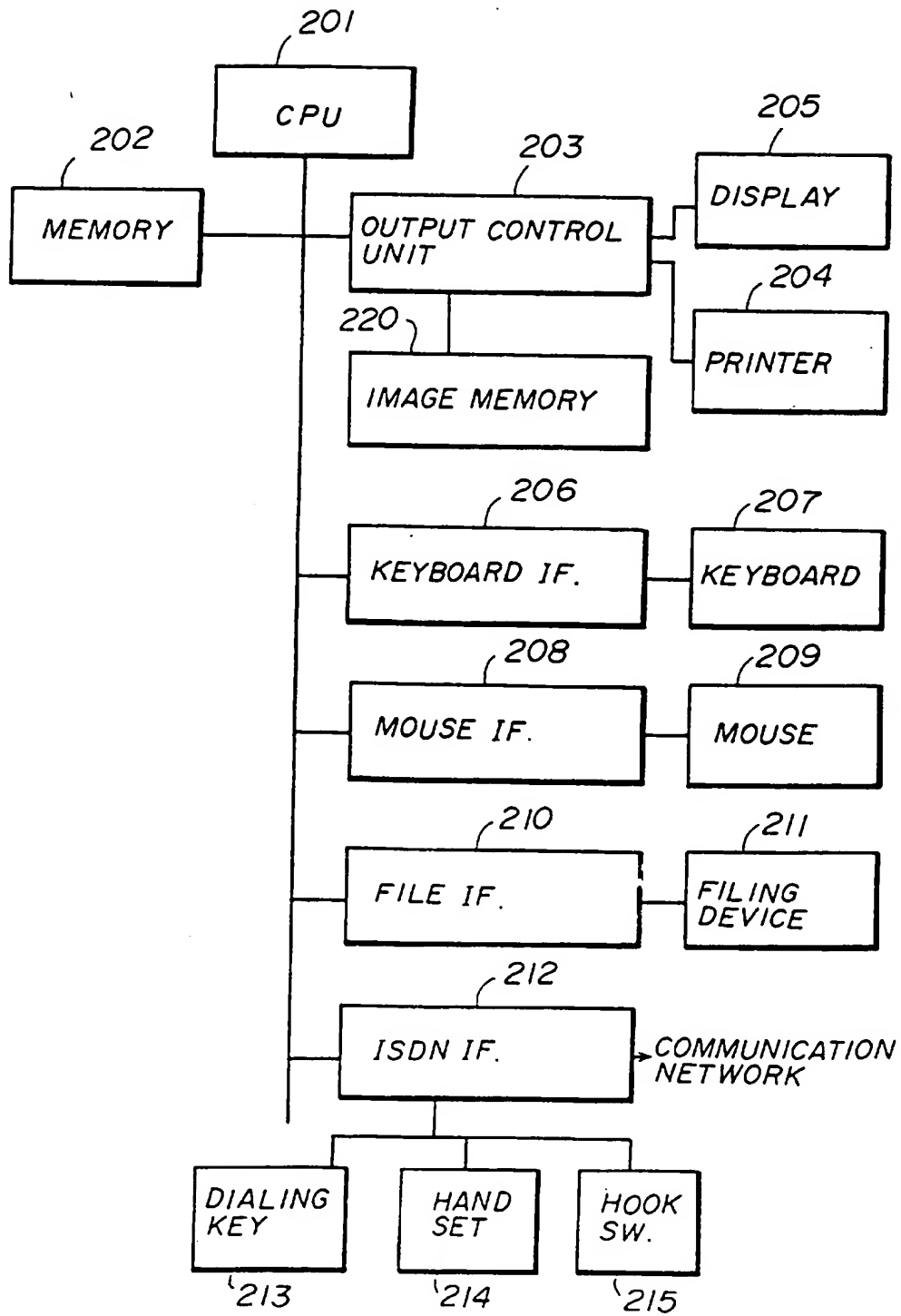


FIG. 5

|           |      |       |        |        |
|-----------|------|-------|--------|--------|
| OPEN FILE | SAVE | PRINT | INSERT | DELETE |
|           |      |       |        |        |

FIG. 6

| OPEN FILE   | SAVE | PRINT | INSERT | DELETE |
|---|------|-------|--------|--------|
| <div>1 : MONTHLY REPORT IN JANUARY<br/>2 : REPORT OF RESULTS IN PATENT EXTRACTION<br/>3 : VIEW GRAPH OF DOCUMENT SHARING<br/>SYSTEM<br/>4 : MONTHLY REPORT IN FEBRUARY<br/>5 : PATENT SPECIFICATION ( SHARED TEXT )<br/>6 : EXPERIMENT DATA</div> |      |       |        |        |

FIG. 7

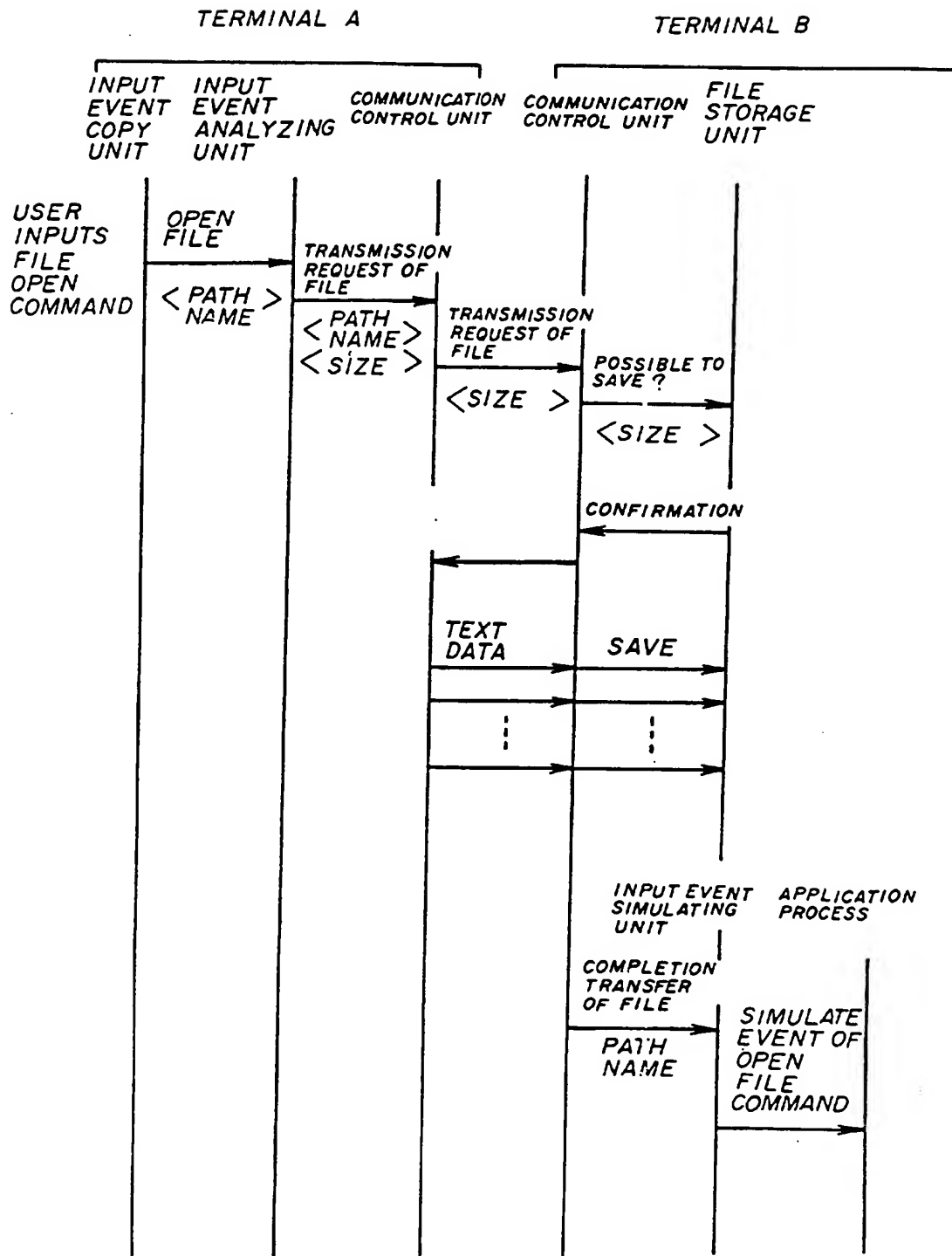


FIG. 8

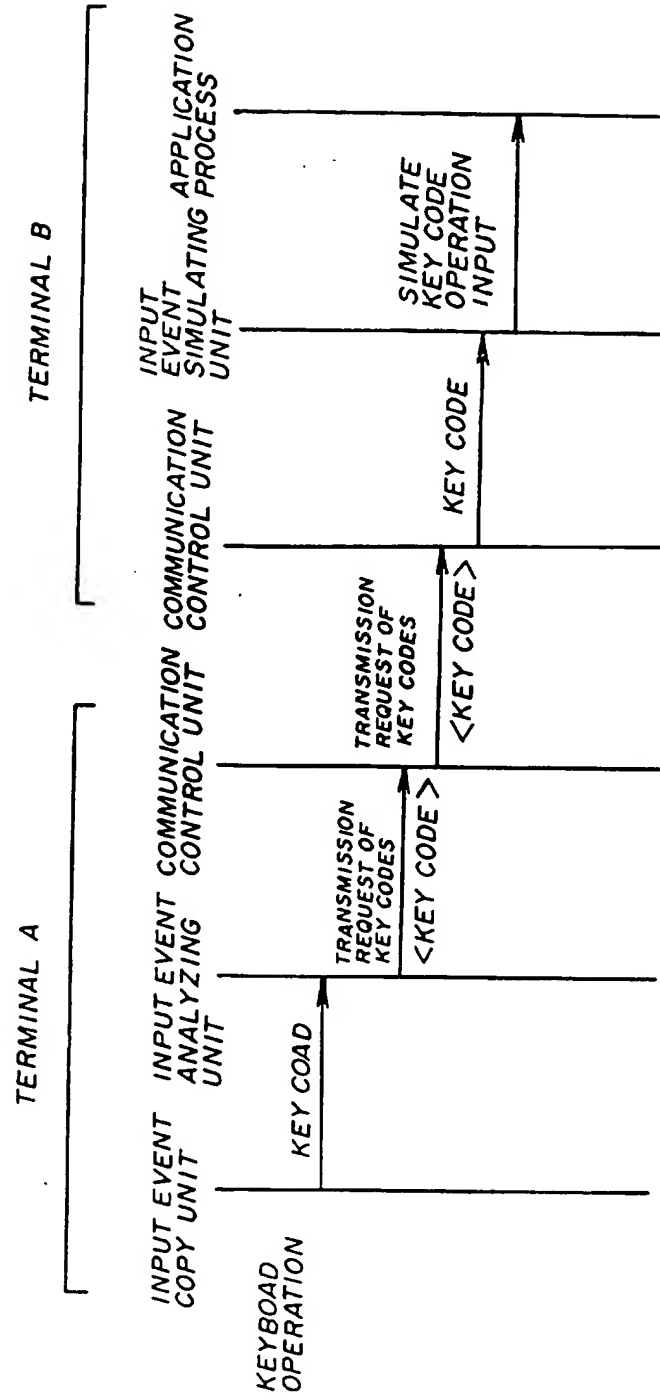




FIG. 9

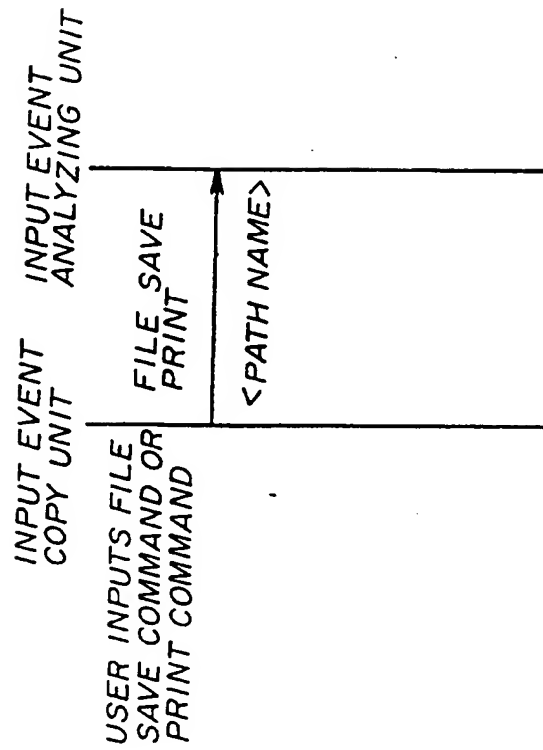


FIG. 10

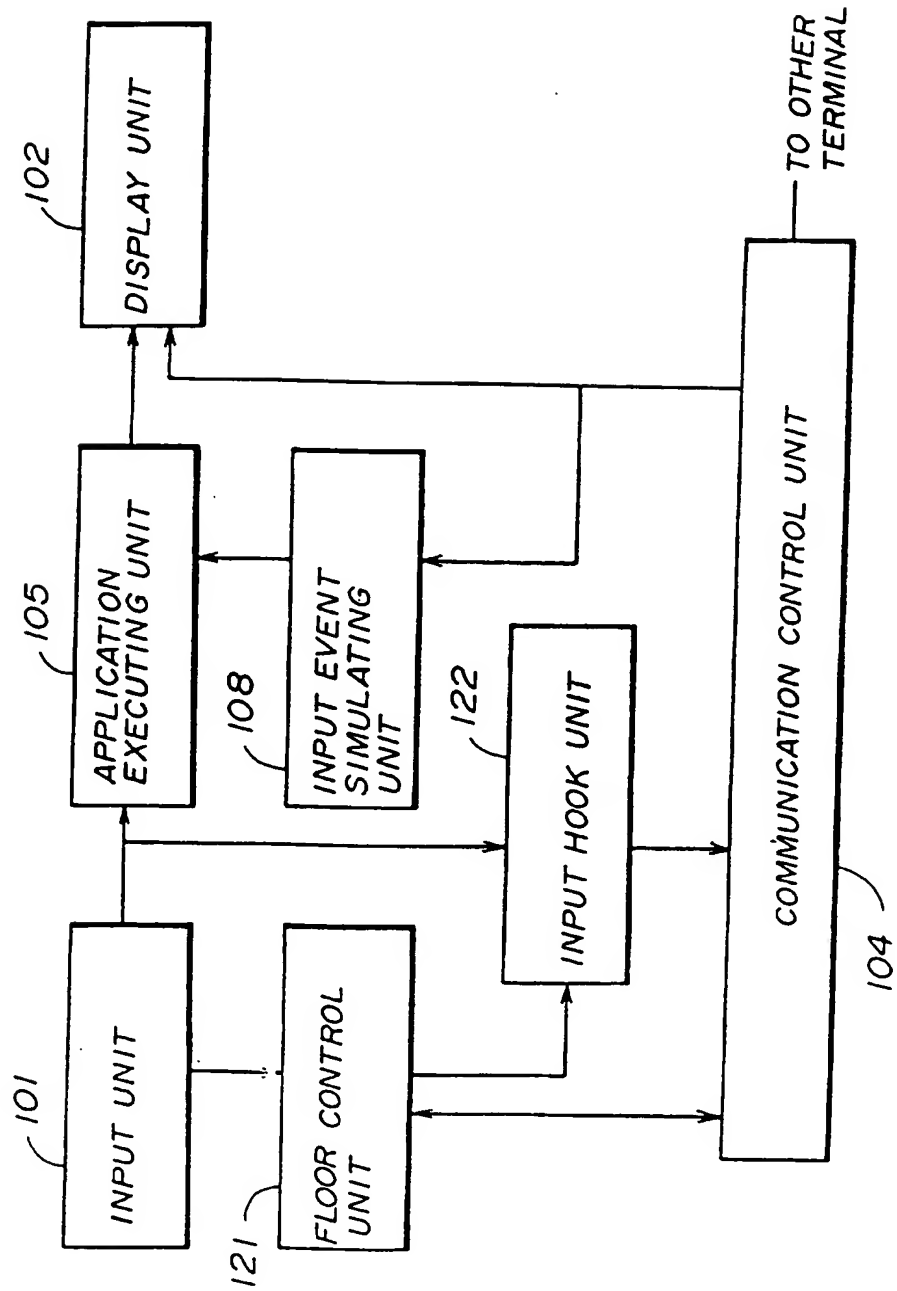


FIG. 11

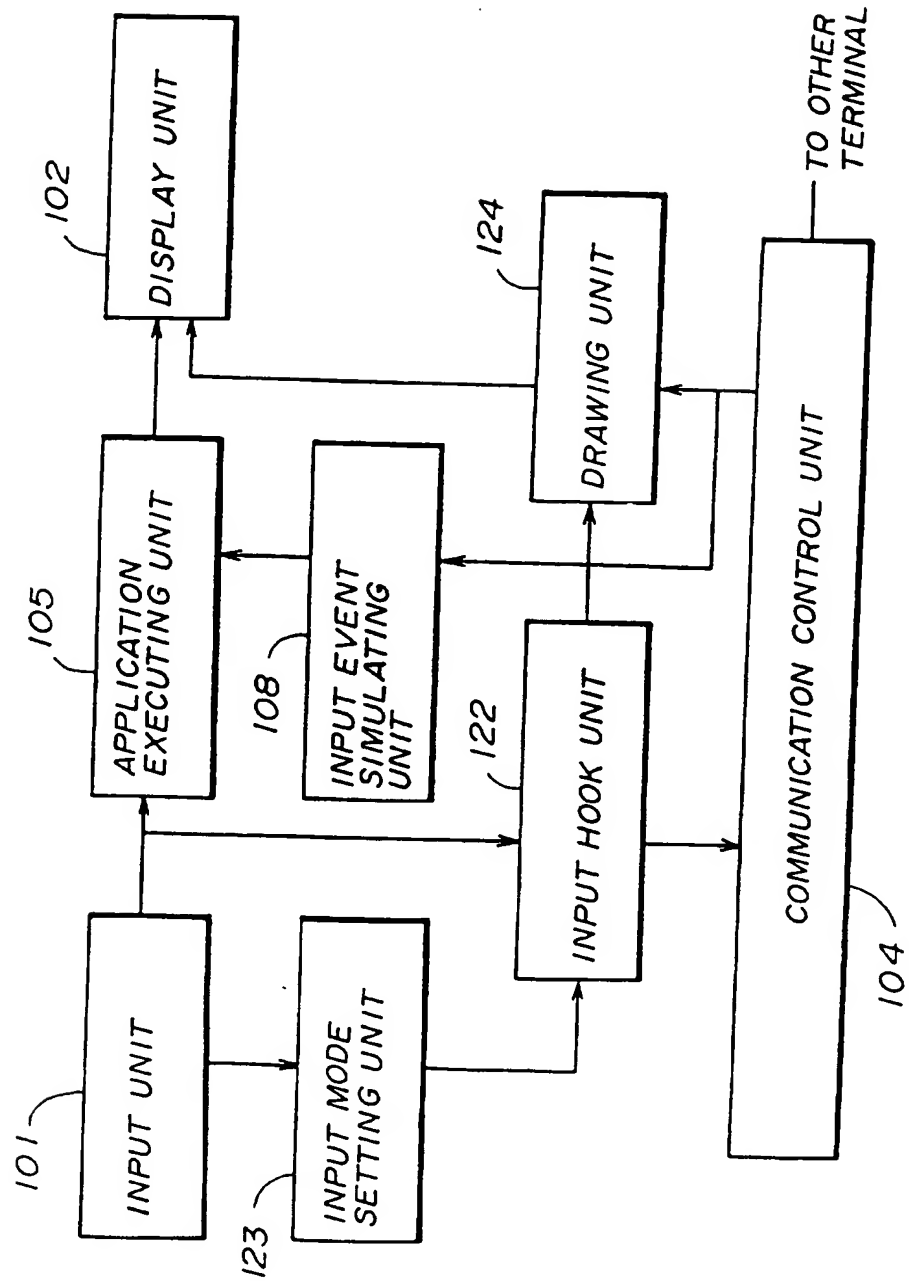
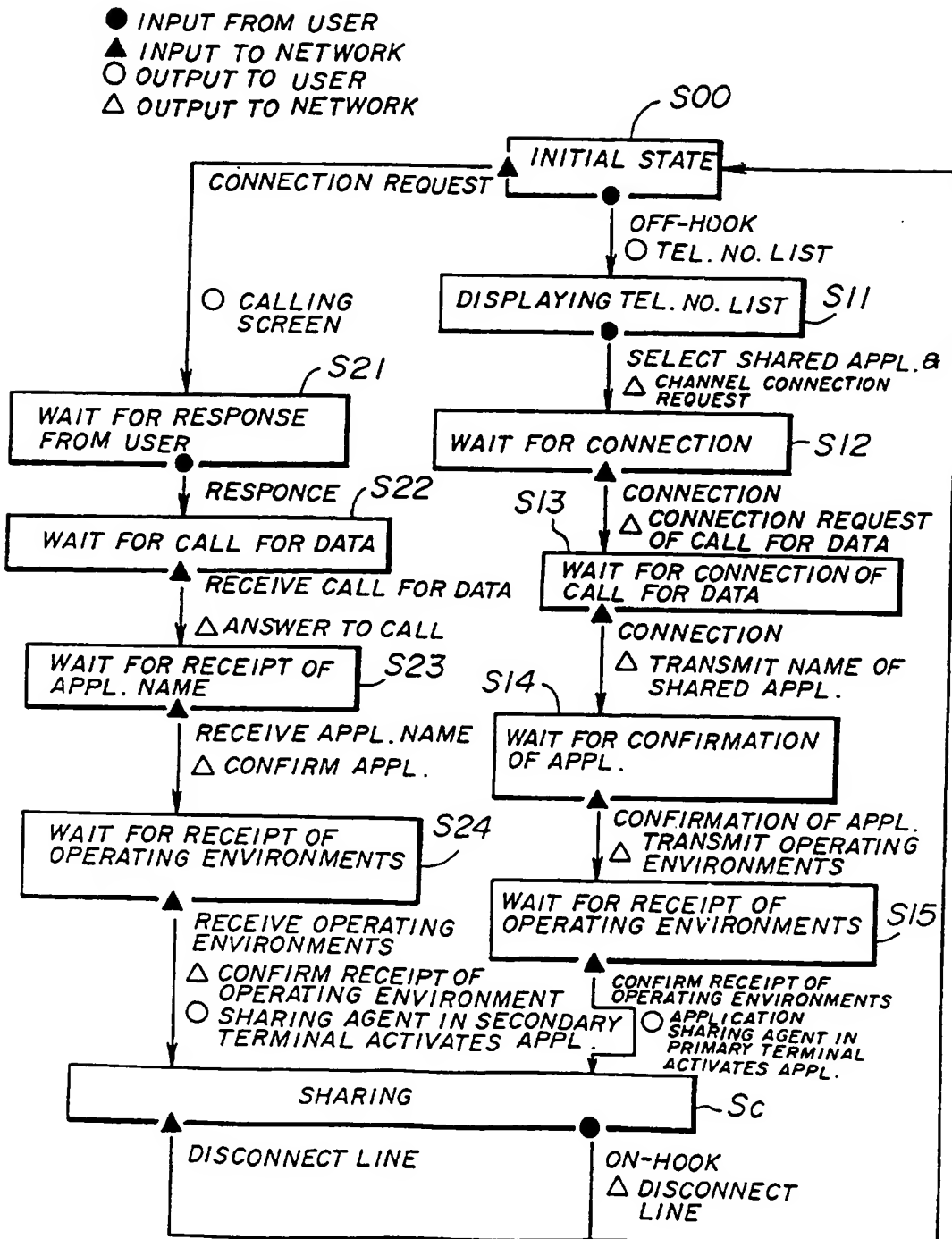


FIG. 12



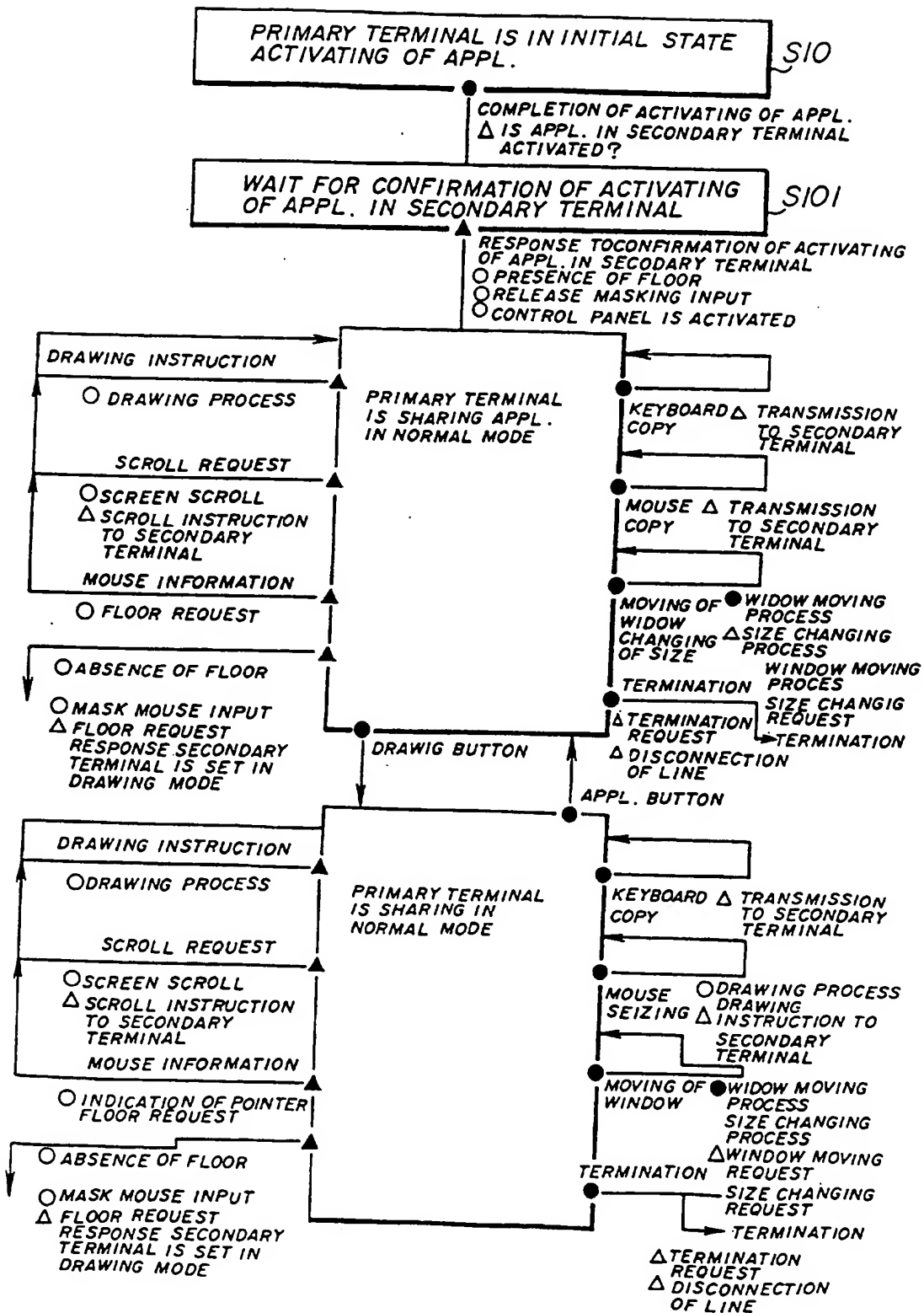


FIG.14

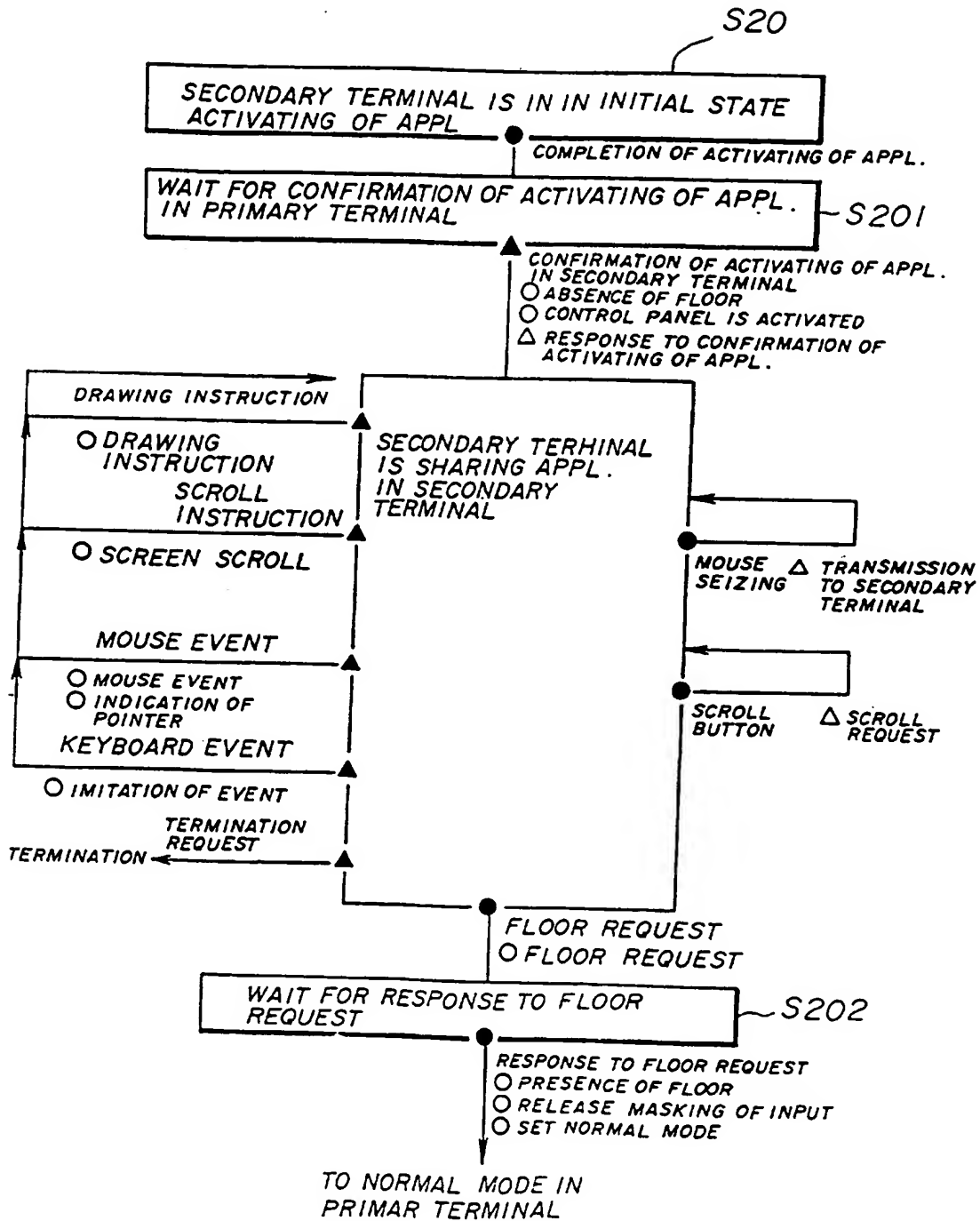


FIG. 15

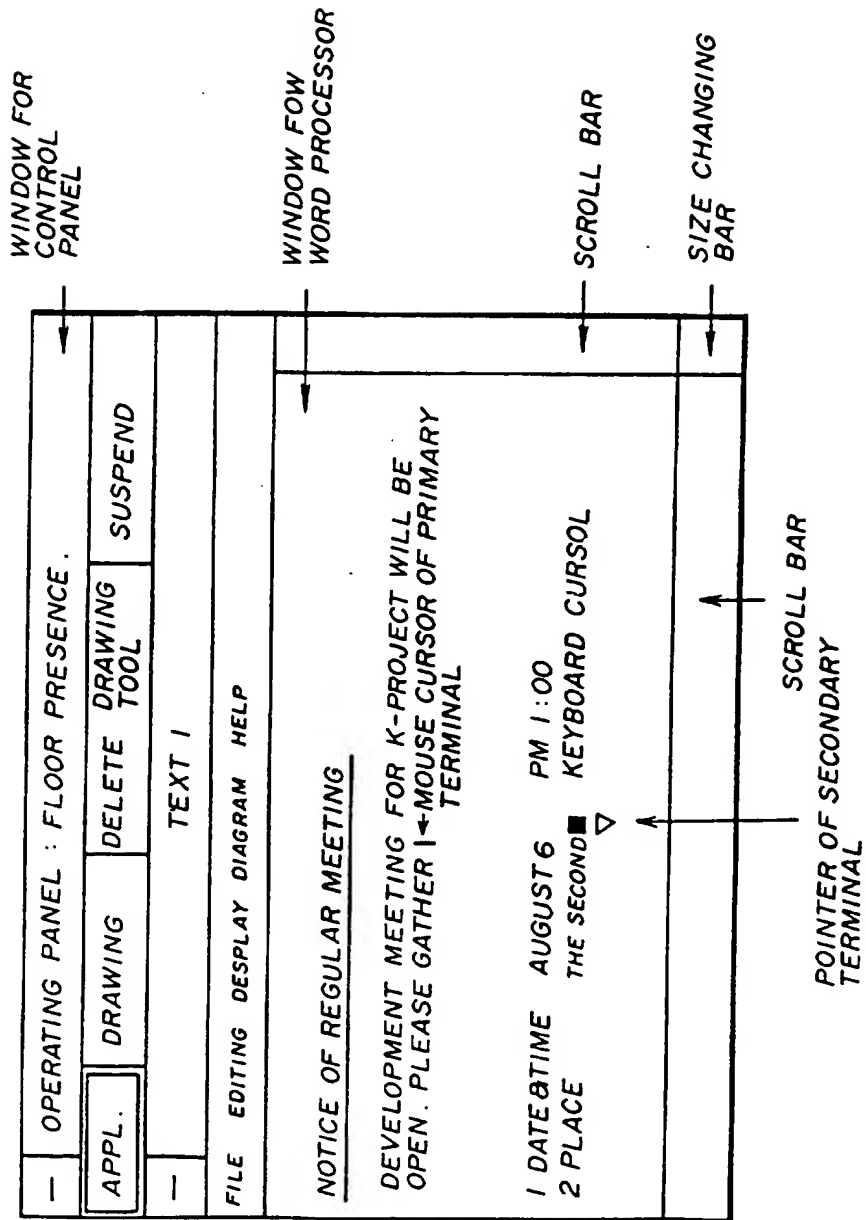


FIG. 16

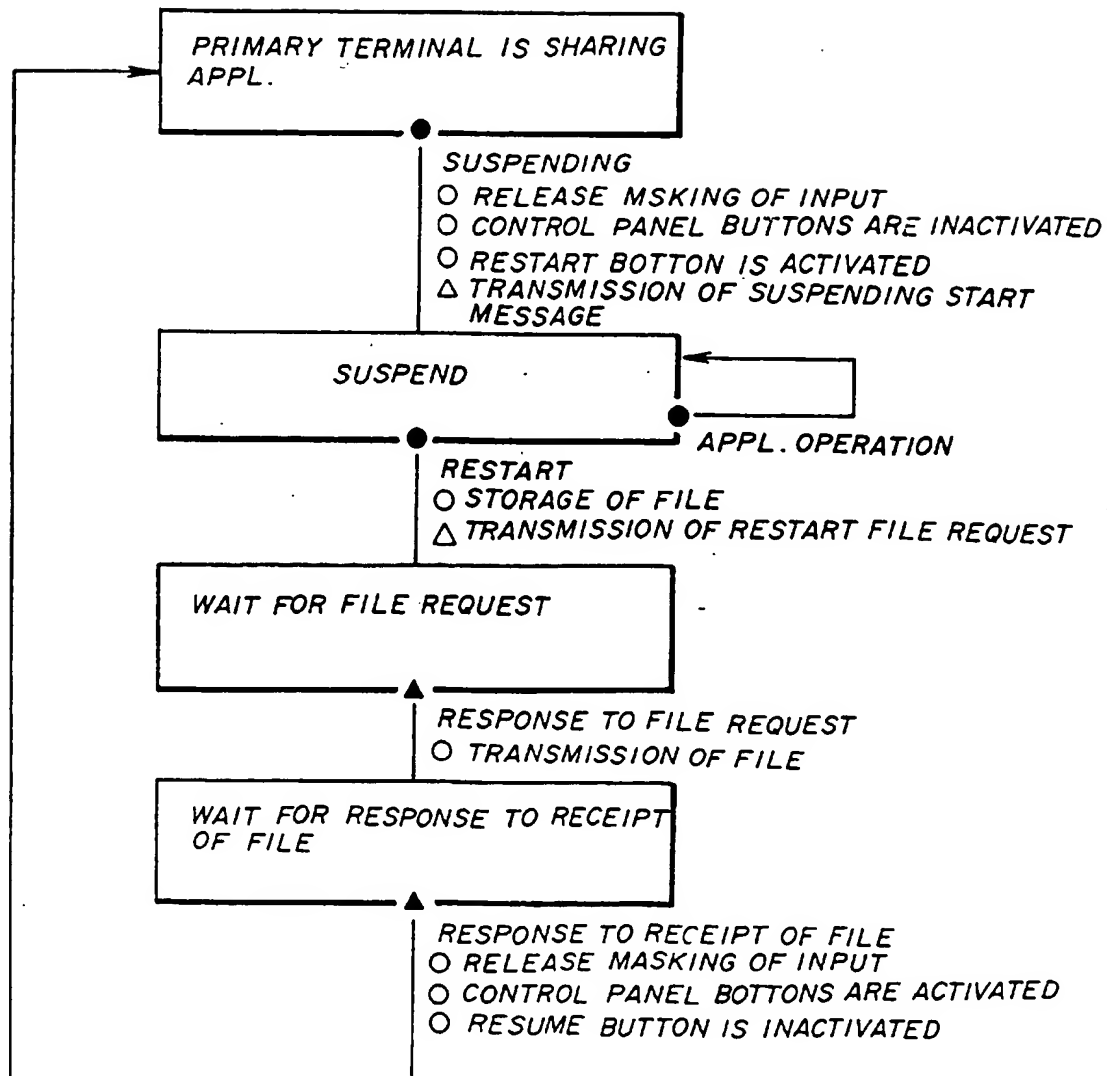




FIG. 17

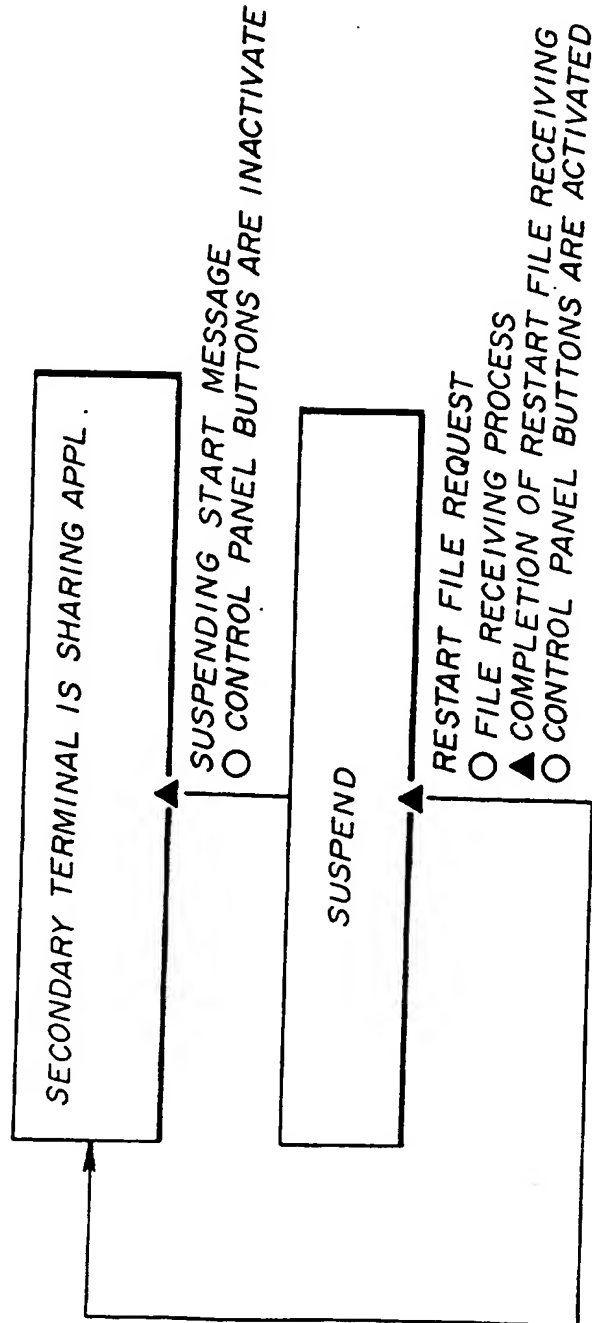
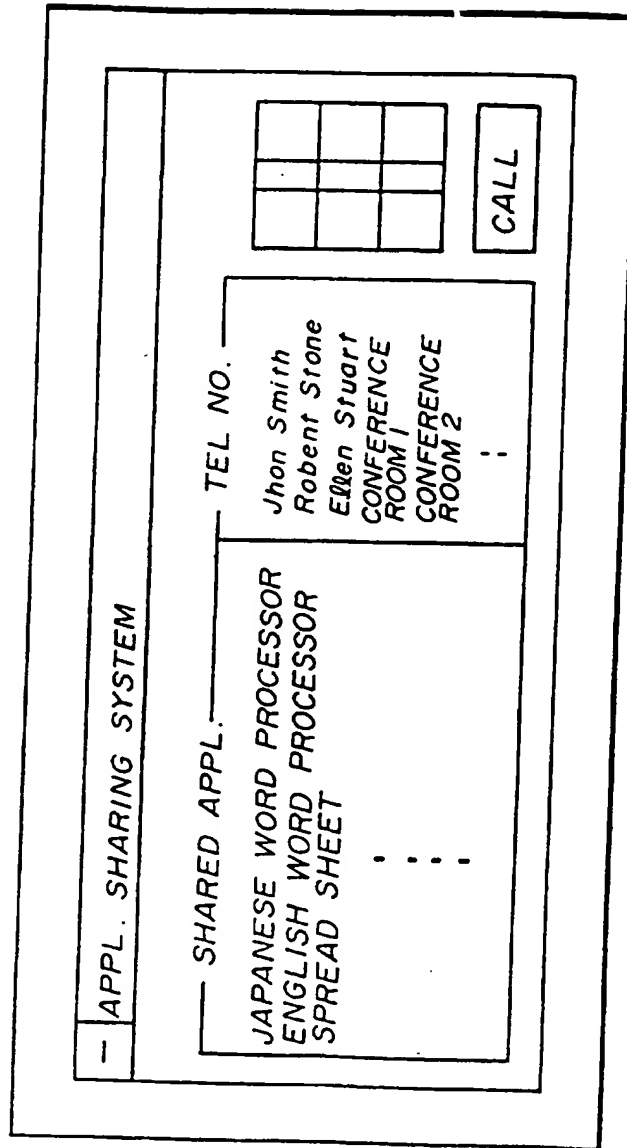


FIG. 18



*FIG. 19*

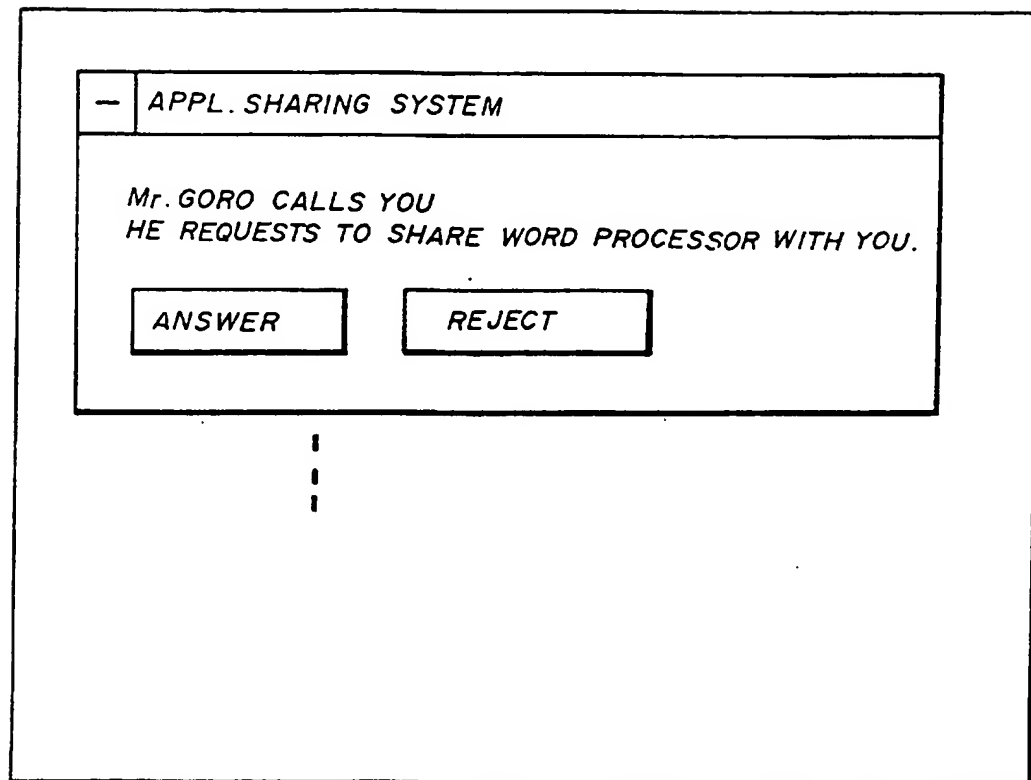


FIG.20A

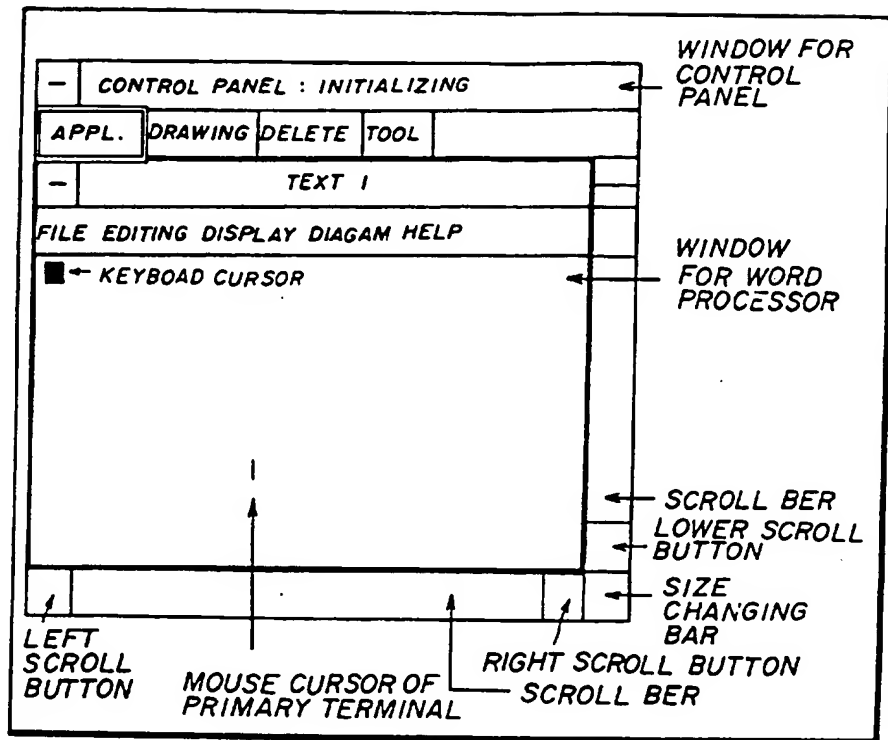


FIG.20B

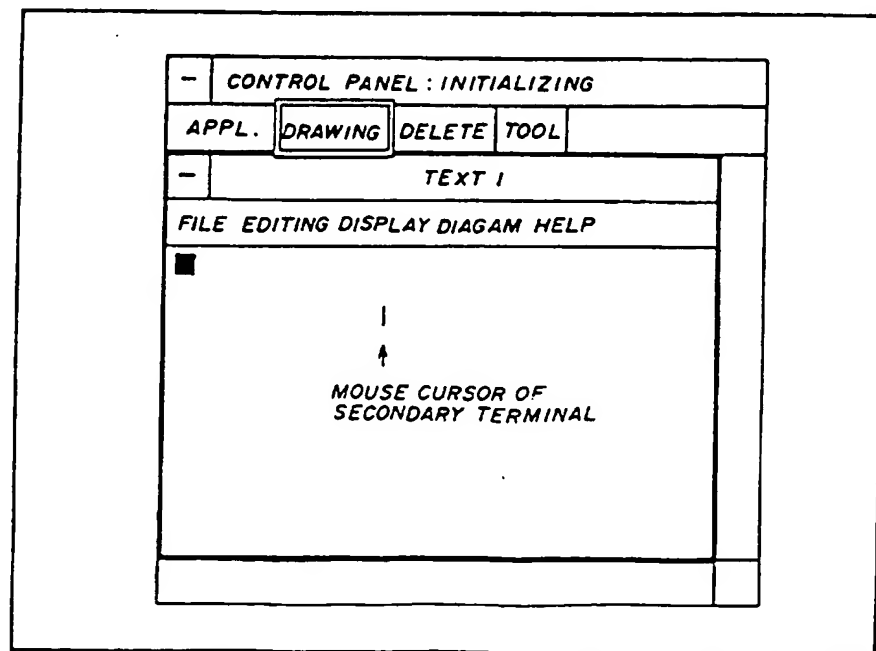


FIG.21A

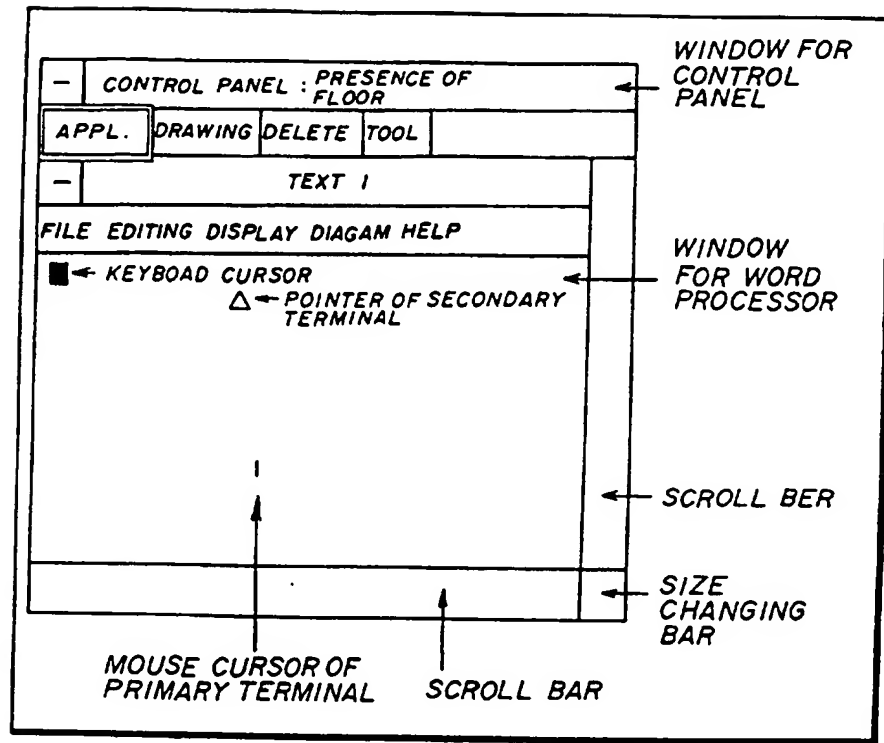


FIG.21B

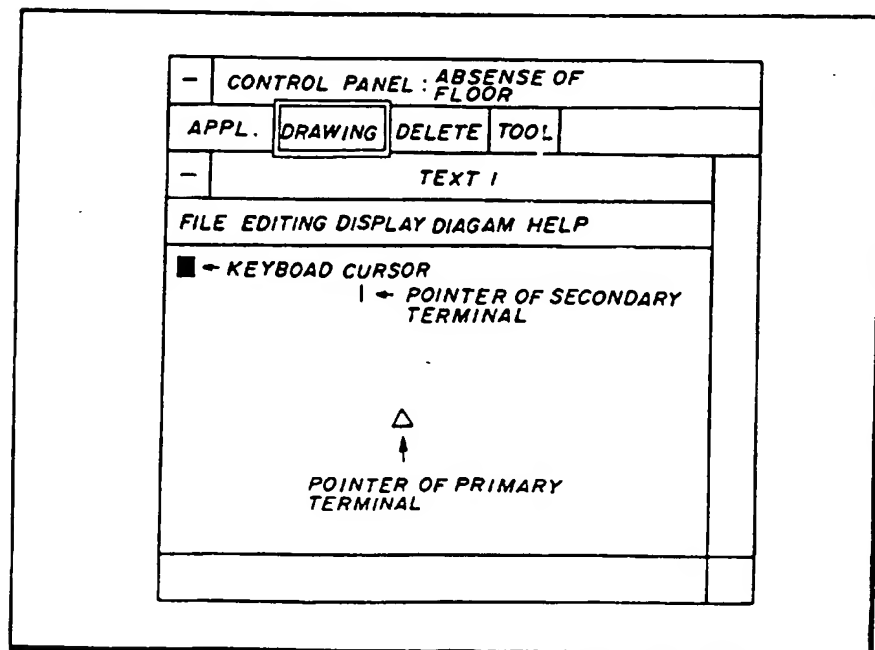


FIG.22A

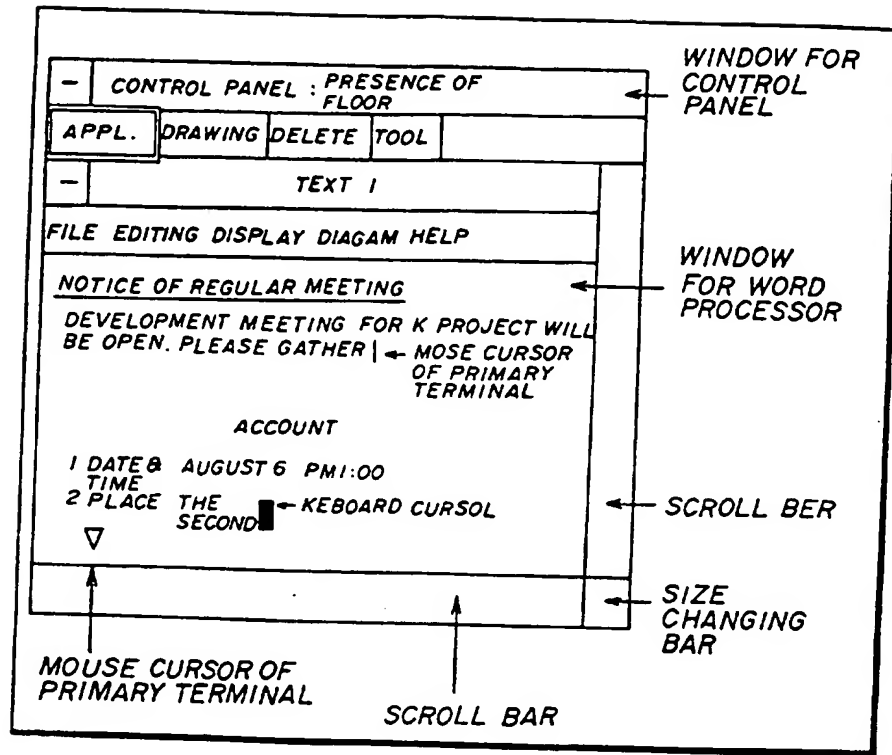


FIG.22B

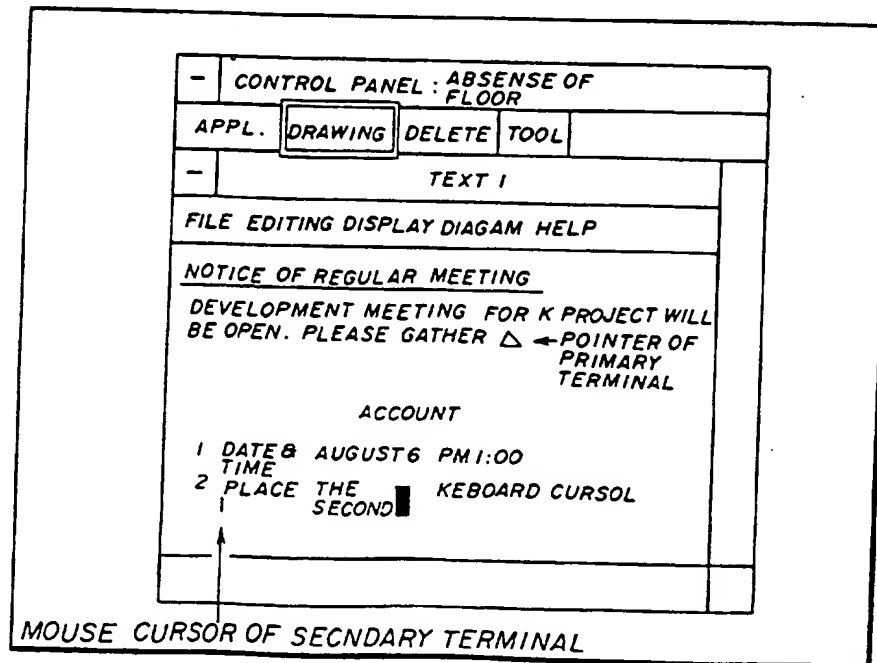


FIG.23A

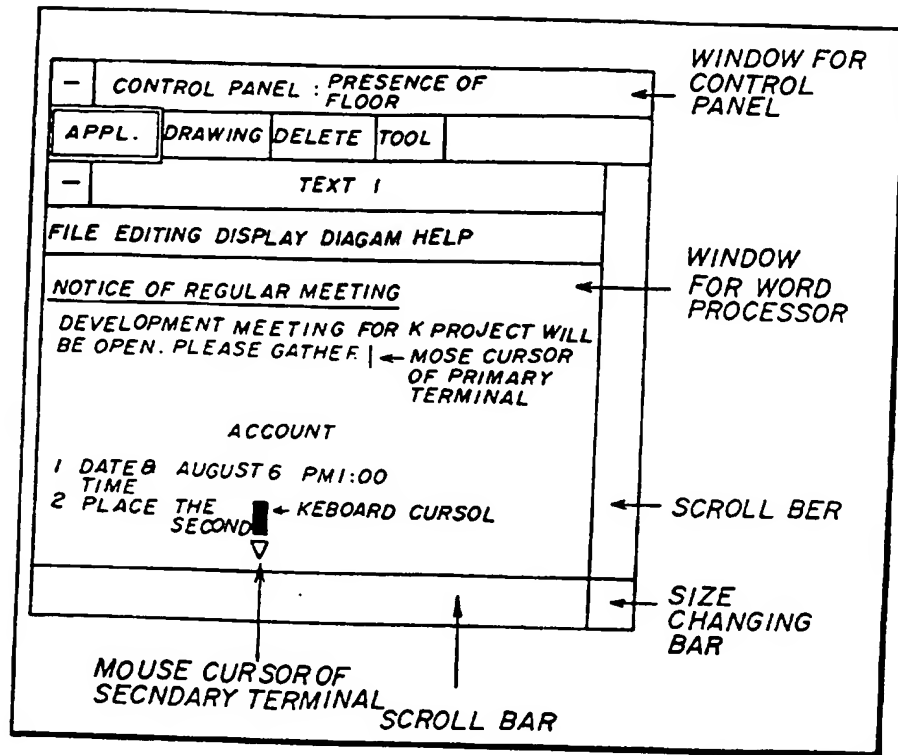


FIG.23B

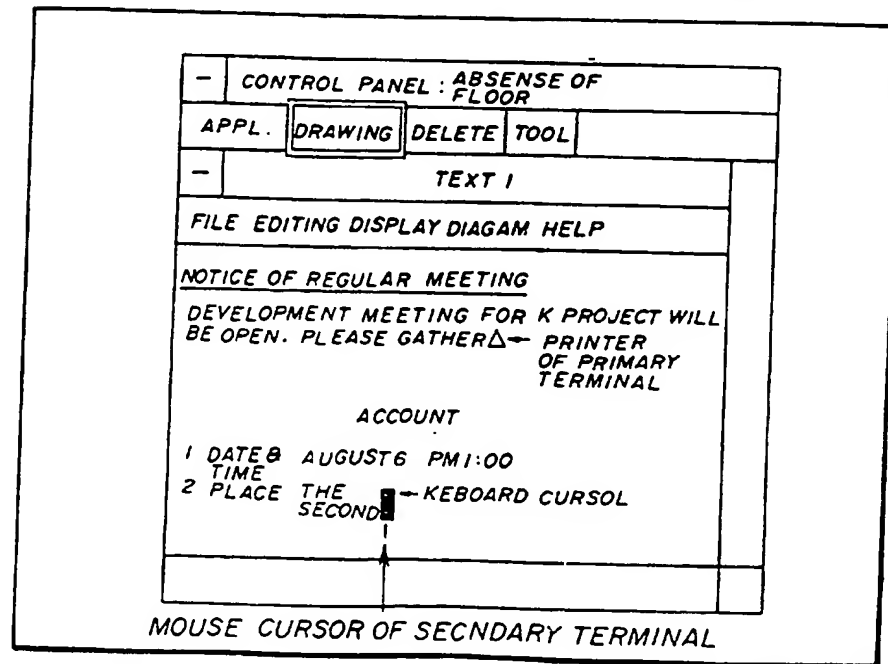


FIG.24A

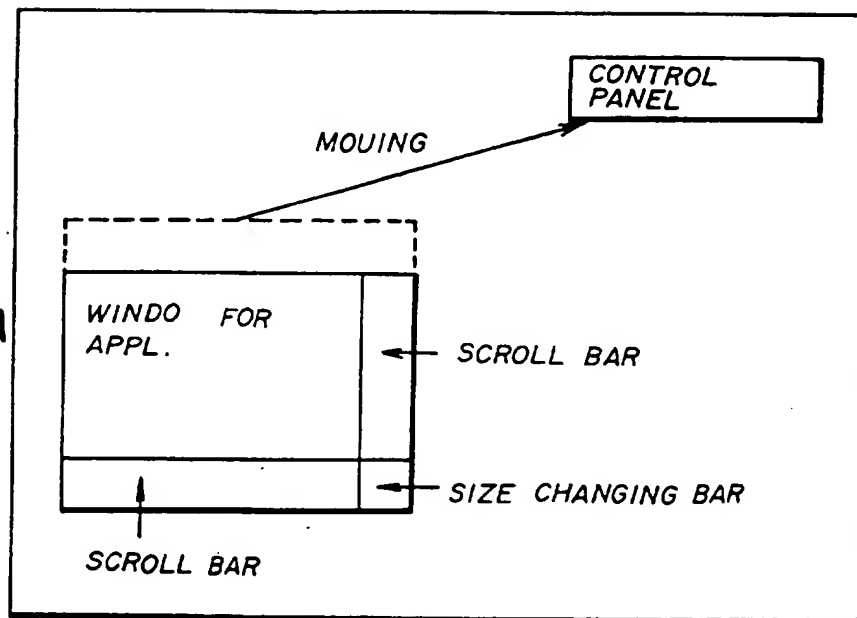


FIG.24B

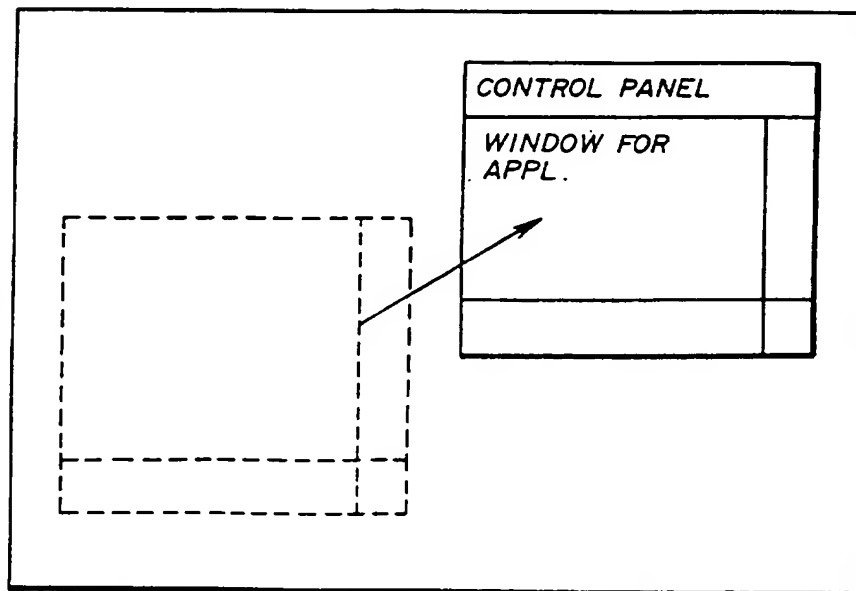




FIG.25A

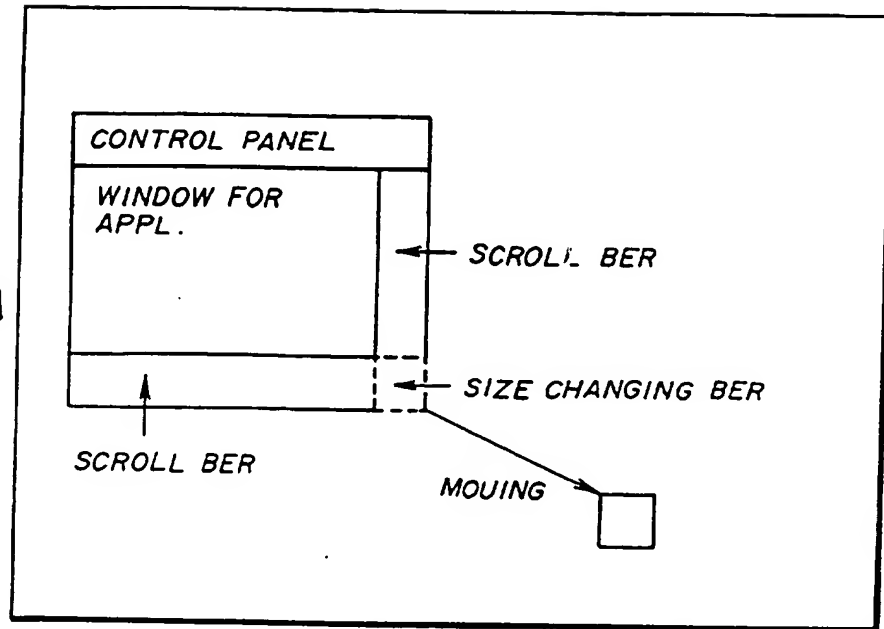


FIG.25B

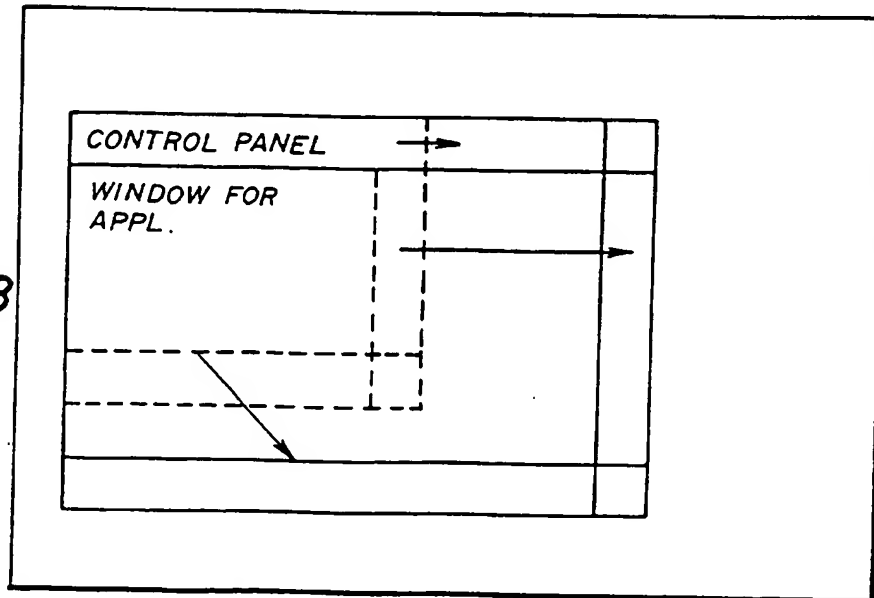


FIG. 26A

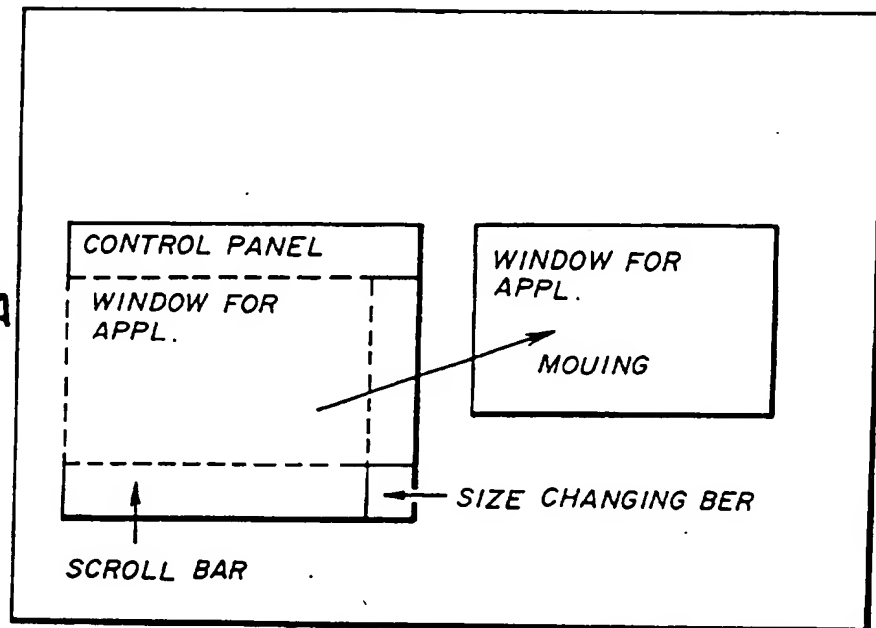


FIG. 26B

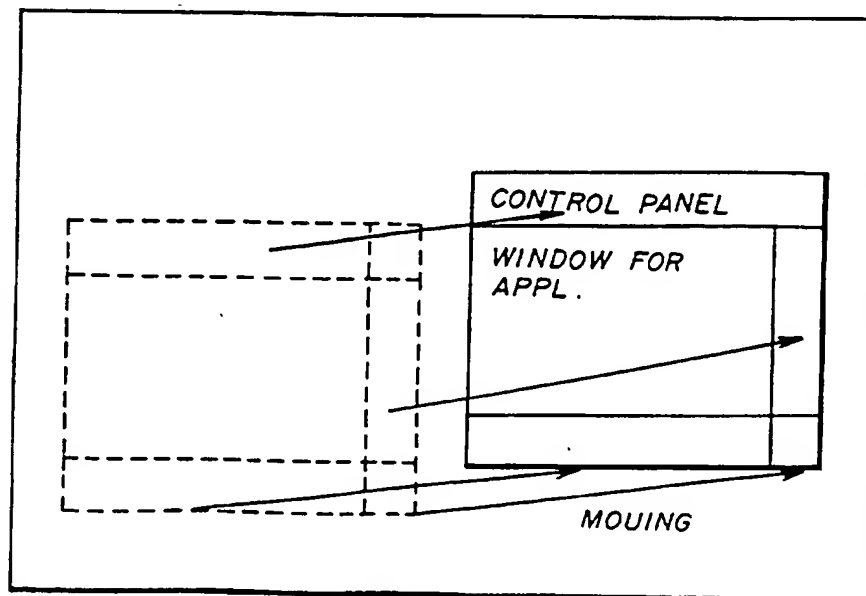


FIG. 27

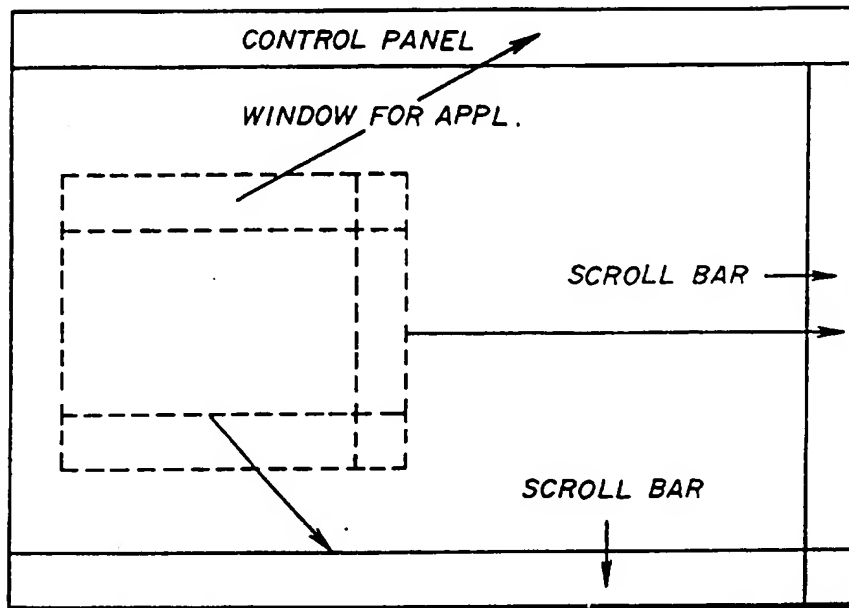


FIG. 28

